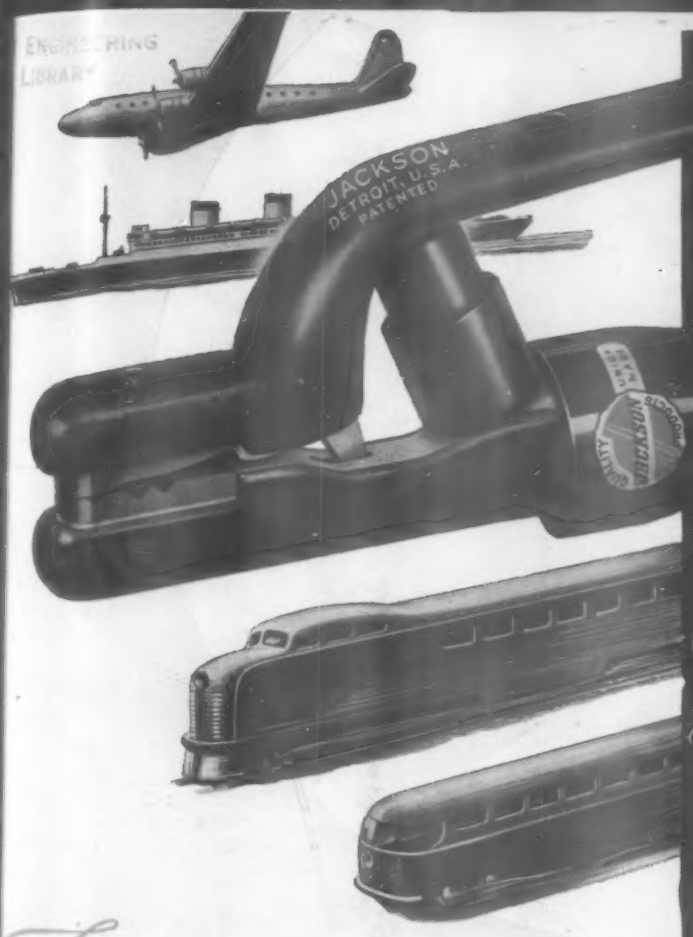
SEPTEMBER, 1946

THE WELDING ENGINEER

PIONEER TECHNICAL PUBLICATION OF THE WELDING INDUSTRY



There's Economy in the Long Run

They are lighter . . . faster . . . safer. Ocean ships and railroad trains are but a few of many things redesigned for modern demands. Our trains travel faster and farther on less fuel. Our planes quickly span the oceans because of this.

Jackson's Featherlight A-4W Holder is another instance of this general trend. It is based on the time-tested principle of tong-type operation and it is fully insulated for safety. Its light metal parts eliminate dead weight. Its streamlined design, its smaller size, its increased lever length all add up to operator appeal and get the job done faster and with less fatigue. And that's what we mean by saying *"There's Economy in the Long Run"*.

LOOK FOR OUR TRADEMARK; USE GENUINE JACKSON REPLACEMENT PARTS.

Jackson's *Featherlight* A-4W

QUALITY JACKSON PRODUCTS

- FEATHERLIGHT: 50% weight reduction.
- TONGS are of tough light weight alloy.
- COPPER JAWS, quickly and easily replaceable.
- INSULATORS: New Crown Type last longer.
- MAINTENANCE: Replaceable Copper Jaws and Crown Type insulators cut maintenance 50%.
- VENTILATION: Free flowing . . . no holder works cooler.
- NEW TONG PIVOT-HINGE: Easily knocked down and assembled.
- CABLE CONNECTIONS: Mechanical.
- CAPACITY: 1/4" electrodes.

JACKSON PRODUCTS

3265 Wight Street, Detroit 7, Michigan

Designers and manufacturers of fully and semi-insulated electrode holders for every arc welding need, including "Quik-Trik" models TA-1 and 3, with easily detached cable end and the "Quik-Trik" Cable Connector. Complete illustrated folder upon request.

Contact your nearest Jackson dealer or write to us.

In Canada: Hollup Corporation Limited, Toronto
Paragon Supplies Limited, Vancouver

There's a future for these features

in your shop

• Prediction: There's complete welding satisfaction ahead . . . once you decide upon a Flexarc All-Purpose Welder for your shop. The WT-4C has ample capacity for heavy production as well as light work, for fabrication and repairs. You can use a wide variety of electrodes from 1/16" to 3/16". In special cases you can use them larger.

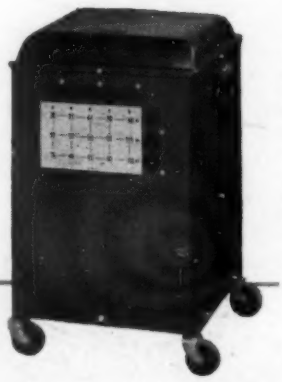
Distinctive Westinghouse features provide 30 steps of current adjustment from 20 to 250 amperes. A built-in capacitor holds power factor between 80% and 90% at one-half to full rated load.

Segregated reactance provides the instantaneous voltage control needed for a stable, easily handled arc. Insulation is Class B . . . the best obtainable. Ventilation is natural. There are no blowers or fans to require attention. A built-in circuit breaker protects the welder and is also used as a switch to turn current on and off at the welder.

And all equipment is included. There is nothing more to buy. Get all the facts by writing for Booklet B-3548. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-70481

Model WT-4, available with or without high power factor.



A SMALLER WELDER

The WT-1C. Here is a low-cost machine for maintenance and light fabrication. Welding current ranges from 20 to 140 amperes in 15 steps. The same principles of design and the same generous proportions of materials are used here as in all Flexarc Welders.

Ask for descriptive literature B-3665 about "50 lessons in Arc Welding". For information about Flexarc Electrodes, ask for Booklet B-3650.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

FLEXARC WELDERS AND ELECTRODES

THE WELDING ENGINEER

THE WELDING ENGINEER, with which is consolidated The Acetylene Journal

Volume 31 • Number 9 **SEPTEMBER, 1946**

T. B. JEFFERSON.....*Editor*
CLYDE B. CLASON.....*Managing Editor*
JOHN H. GIROUX.....*Assistant Editor*
DONALD D. HOGATE.....*Chief, Washington Bureau*
HENRY W. YOUNG....*West Coast Editor* (621 So. Hope St., Los Angeles 14)
JOHN CHAPMAN....*World News Director*
A. M. MORRIS.....*General Manager* (330 W. 42nd St., New York City)

DISTRICT MANAGERS

T. E. Depew, 330 W. 42nd St., New York City 18 ● Joseph H. Allen, Jr., 520 N. Michigan Ave., Chicago 11 ● E. J. McOsker, 1510 Hanna Bldg., Cleveland ● Roy Phelan, 621 S. Hope St., Los Angeles ● John Otterson, 68 Post St., San Francisco.

Published monthly by
THE WELDING ENGINEER PUBLISHING CO.
A Division of
McGRAW-HILL PUBLISHING CO., INC.

Copyright 1946 All rights reserved
By McGRAW-HILL PUBLISHING CO., INC.

EDITORIAL AND PUBLICATION OFFICE:
520 N. Michigan Ave., Chicago 11
EXECUTIVE AND SALES OFFICES:
330 W. 42nd St., New York 18, N. Y.

The Welding Engineer Publishing Company. Entered as second-class matter January 20, 1916, at the post office at Chicago, Ill., under the act of March 3, 1879. **Subscription rates:** single copy 35c. United States and Possessions: one year $3, two years $4, three years $5. Canada: one year $4, two years $6, three years $8. Pan-American countries: one year $6, two years $10, three years $12. All other foreign countries: one year $15, two years $25, three years $30. Please indicate position and company connection on all subscription orders.

Address all correspondence regarding circulation matters to J. E. Blackburn, Jr., Vice-President for Circulation Operations, McGraw-Hill Publishing Co., 330 West 42nd St., New York 18, N. Y.

A McGRAW-HILL PUBLICATION

IN THIS ISSUE

ARTICLES

Research

Welding Methods for Alloy-Steel Piping—I..... 31
ERIC R. SEABLOOM

Underwater Induction Heating..... 36

Maintenance

Hard-Facing, Antidote to Wear..... 37
FRED M. BURT

Construction

Radiant Heating at Kankakee..... 42
CLYDE B. CLASON

Building a 300-Ton Welded Trailer..... 62
C. W. LYTTON

Production

Servel Gas Welds Gas Refrigerators..... 44
GERALD E. STEDMAN

Welding Bulldozers on an Assembly Line—II..... 49
WALTER J. BROOKING

Seam Welding Turbojet Elbows..... 52
FRANK J. HARKINS

48 Welds Made at One Stroke..... 59

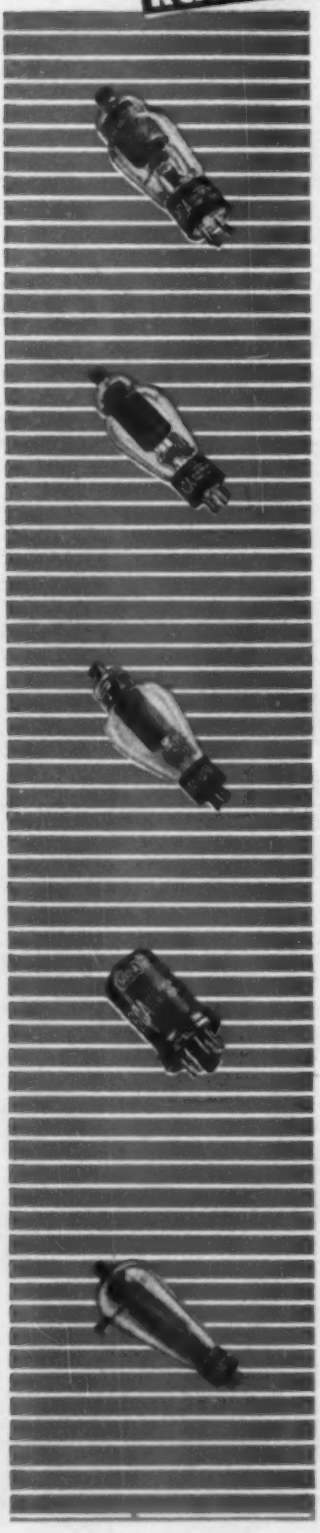
DEPARTMENTS

Editorial 29
The Technical Slant..... 64
New Products to Use 68
On the Job 78
Engineering Data Sheet No. 72 83
Free Literature 85
News of the Industry 88
About People 98
From the Patent Office 106
Searchlight Section 116
Advertisers in This Issue 118

Meet a few members of RCA
growing family of industri

RCA THYRATRONS

For Welding Control, Pow
and Other Industri



RCA-3C23 is a three-electrode, gas-and-mercury-vapor type for regulated-rectifier applications. It has excellent constancy of control characteristic over temperature range of −40° to +80° C.

Peak inverse anode volts, 1250; maximum average anode amperes, 1.5.

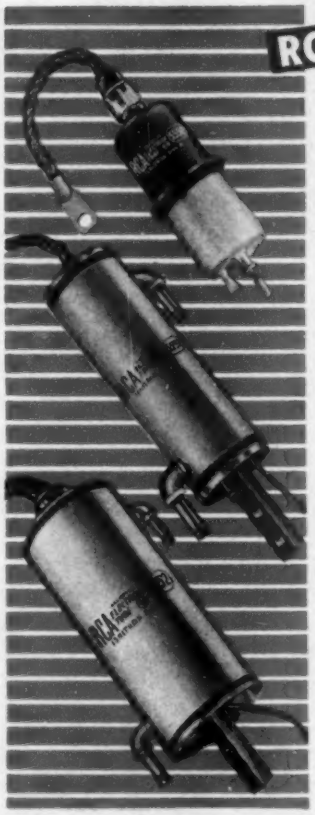
RCA-5557 is a three-electrode, mercury-vapor type for use in relay circuits where current flow is desired when there is no grid excitation. Peak inverse anode volts, 5000; average anode amperes, 0.5.

RCA-5559 is a three-electrode, mercury-vapor type for use in relay circuits in which current flow is desired when there is no grid excitation. Peak inverse anode volts, 1000; average anode amperes, 2.5.

RCA-502-A is a small, metal thyratron of the gas tetrode type for use in compact regulated-rectifier equipment. Its control characteristic is independent of ambient temperature over a wide range (−55° to +90° C). Peak inverse anode volts, 1300; average anode amperes, 0.1.

RCA-5560 is a four-electrode, mercury-vapor type for service where a high-impedance supply actuates the control grid and the actuating grid power is small. Peak inverse anode volts, 1000; average anode amperes, 2.5.

RCA IGNITRONS

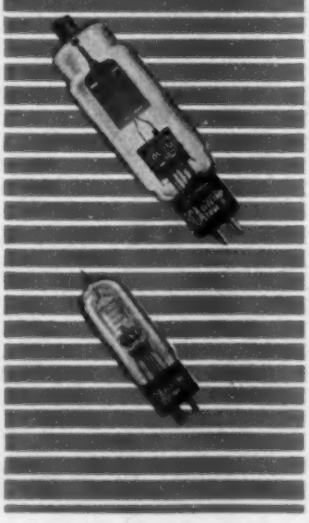


RCA-5550 is a compact stee jacketed type for use i welder-control service. Wi handle 300-kva demand, an is equivalent to a 150-amper magnetic contactor. Coolin clamp may be either air- o water-cooled.

RCA-5551 is a water-cooled steel-jacketed type fo welder-control service, fo power conversion and fo intermittent rectifier service. Will handle 600-kva demand in welder-control service and is equivalent to a 300-ampere magnetic contactor.

RCA-5552 is a water-cooled steel-jacketed type for welder-control service, for power conversion and for intermittent rectifier service. Will handle 1200-kva demand in welder-control service, and is equivalent to a 600-ampere magnetic contactor.

RCA HIGH-VOLTAGE RECTIFIERS



RCA-8020 is a filament type of half-wave, high-vacuum rectifier for applications requiring high dc voltage and low dc current. Maximum peak inverse plate voltage, 40,000; maximum peak plate current, 750 milliamperes; maximum average plate current, 100 milliamperes.

RCA-579-B is a filament type of half-wave, high-vacuum rectifier for applications requiring high dc voltage and low dc current. Maximum peak inverse plate voltage, 20,000; maximum peak plate current, 270 milliamperes; maximum average plate current, 25 milliamperes.

★ RESEARCH

Welding Methods for Alloy-Steel Piping

BY ERIC R. SEABLOOM
Supervising Engineer,
Crane Co. Research Laboratories

Steels for high-temperature usage or corrosion resistance require special treatments, but they are easy to weld if you know how, contends Mr. Seabloom. This article begins a new series that we think will rate among the most valuable material ever published in THE WELDING ENGINEER.

Fig. 1—Thermal characteristics of metals are revealed on photographic film by the optical dilatometer. A useful tool in determining heat treatments this instrument also gives clues to the weldability of alloy steels

WELDING is being employed to a great extent in the fabrication and erection of piping for many types of service. Most of this has been with plain-carbon and simple low-alloy steels. As pressures and temperatures continue to increase, and with the anticipated growth of process industries, more alloy steels will, no doubt, be employed in the near future. The groups of alloy steels that will, most likely, find greater usage are the chromium-molybdenum, straight-chromium and the chromium-nickel varieties since these display improved high-temperature stability, oxidation and corrosion resistance.

Though these alloy steels are not as weldable as the plain-carbon steels, most of them can be joined by various welding processes with excellent results. Some, however, require special techniques involving preheating, stress relieving or heat treatment.

As an aid to those who are confronted with the problems of welding such alloys, a series of four articles will be presented in THE WELDING ENGINEER dealing with the characteristics of materials pertinent to their weldability, the joining processes applicable to welding of piping, suggested types of joints, suitable filler metals and recommended preheats and heat treatments. This first article will cover the ½ to 10% chromium-molybdenum alloys, the second 10 to 30% straight chromium steels and the third chromium-nickel austenitic stainless steels. The fourth will discuss soldering.

CHROMIUM-MOLYBDENUM STEELS

The chromium steels shown in Table I have small additions of molybdenum to impart creep strength and resistance to temper embrittlement. These steels, consequently, are used extensively on high-temperature service.

The lower alloy grades, such as ½%, 1% and to a minor degree 2% chromium, are being employed in steam power plants operating at 900 to 1,000 F in order to offset the danger of graphitization in the weld contact zones that has been experienced with some of the carbon-molybdenum steels. Alloy steels containing from 2 to 10% chromium are used extensively in oil refineries at high temperatures in order to obtain oxidation and

corrosion resistance, the chromium content selected depending upon the temperature and the corrosive environment.

Heating-Cooling Characteristics

The chromium-molybdenum alloy steels are air-hardening; that is, the welds and adjacent parent metals harden when air cooled from the welding heat. These steels are air-hardening because of suppressed transformations that occur upon cooling from high temperatures, which is the reason why some of them are apt to crack when welded. The tendency toward air-hardening or suppressed transformation is dependent on the chromium and carbon contents. The degree of hardening and suppressed transformation is not so marked in the ½ to 2% chromium types of low carbon content, but with higher carbon it becomes more pronounced. The 4 to 10% chromium grades display the same characteristics regardless of the carbon content, although higher carbon aggravates the condition.

Suppressed transformations are determined by a dilatometer (Fig. 1), which records the expansion and contraction that occur in metals upon heating and cooling. Fig. 2 shows heating and cooling curves on plain-carbon, carbon-molybdenum and 4-6% chrome, ½% molybdenum steels. It will be observed that these steels expand when heated according to a slope of approximately a straight line or a smooth curve until a point is reached at which they contract. Contraction continues over a considerable range of temperatures, beyond which each steel again expands according to a slope of nearly a straight line. The temperature range in which the contraction takes place is known as the transformation range. It is in this range that steel changes from its low-temperature (ferritic) to high temperature (austenitic) state.

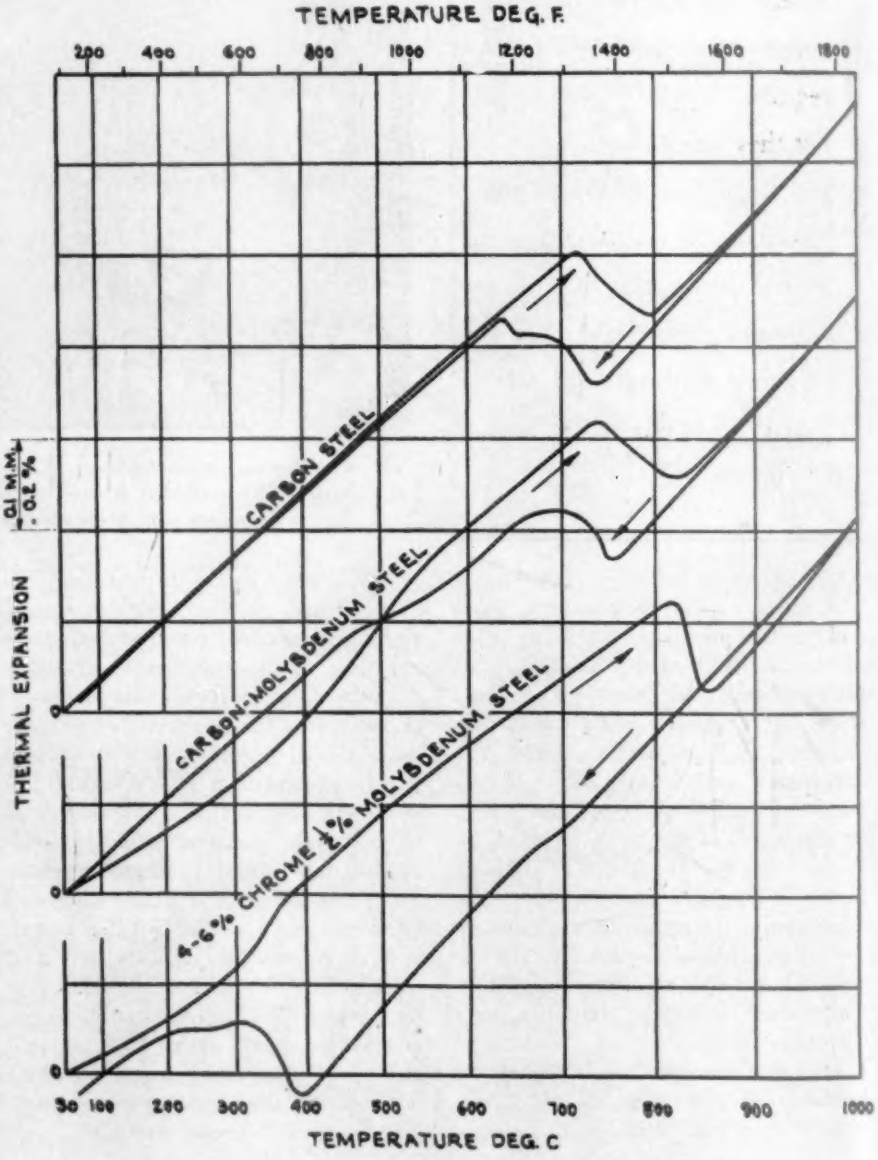
Upon cooling, a reverse effect is obtained. In the case of plain-carbon steel, the transformation from the austenitic to the ferritic state is well defined at the temperature range of 1,400 to 1,150 F. In carbon-molybdenum steel, however, the transformation on cooling is not quite as well defined as in carbon steel. The major part occurs at about the same temperature range as in a plain-carbon steel, but another part is suppressed to about 980 F, indicating what is known as the phenomenon of "split transformation." Nevertheless, in both of these steels, major contractions associated with the transformation upon cooling occur at temperatures sufficiently high to give the metal enough plasticity to readjust itself internally, thus relieving most of the internal strain and eliminating the potential danger of cracking. Consequently, no difficulty is encountered in welding steels of these two types.

Chrome Transformations

In the case of 4-6% chrome, ½% molybdenum steel, only a very weak transformation occurs at 1,250 F. The major part is suppressed to about 700-400 F. The split and suppressed transformations are characteristic of chromium-alloy steels and are accounted for by their thermal sluggishness. The important thing to note about these suppressed transformations is that they occur at temperatures when the metal is no longer plastic, thus creating internal strains which may result in cracking unless properly taken care of by suitable techniques.

Consulting Fig. 2 again, it will be noted that the presence of internal strain in the 4-6% chrome, ½% molybdenum steel is indicated by the fact that the specimen did not return to its original length, being somewhat

Fig. 2—Dilatometer curves for carbon, carbon-molybdenum and 4-6% chromium ½% molybdenum steels. Note different transformations upon cooling



shorter than it was before the heating-cooling cycle. It is natural to expect that steels of this type will show definite tendencies to crack, either during or after welding operations. When proper procedures of preheating, welding, stress relieving and/or heat treatment are followed, however, such steels can be welded without difficulty. The resultant welds will also be strong, sound and ductile, meeting the requirements of the ASME Boiler Code and the ASA Code for Pressure Piping on procedure and operator qualification tests. As proof, Fig. 9 shows typical weld-bend test bars in 1.00% chromium, ½% molybdenum steel.

Oxy-Acetylene Welding

The lower chromium ranges of these steels can be successfully welded with the oxy-acetylene flame without many precautionary measures, provided welding rods giving deposited weld-metal analyses equivalent to the parent metals are available. This, however, may not be the case for all types of steel.

The flame adjustment is important. A neutral flame is recommended with a slightly lower heat than that normally employed for plain-carbon steels. An oxidizing flame should be avoided since chromium oxidizes readily and will be burned out. Proper fusion will also be difficult to obtain with an oxidizing flame. A reducing (excess acetylene) flame will increase the carbon content in the weld metal and so add to the air-hardening properties. Special fluxes developed for the gas welding of chromium steels are able to dissolve the chromium oxides and aid in producing satisfactory welds, especially in the higher chromium steels.

Preheating of the adjacent areas to be welded, at 400 F minimum, is essential to prevent cracking, but since this is accomplished virtually automatically by the oxy-acetylene process no special preparations are required. The welds should be cooled slowly from welding heat and stress relieved or heat treated after welding. (Heat treatment is covered in a later paragraph since this is the same for any process of welding.)

Welding grooves recommended are the single-vee butt type and fillet or socket joints as shown in Fig. 3. Socket-type fittings may not be available in all grades of these alloys. Welds can be made in all positions.

Atomic-Hydrogen Welding

Brazing or soldering is not generally employed since these alloys are primarily used at elevated temperatures and the joining materials do not possess

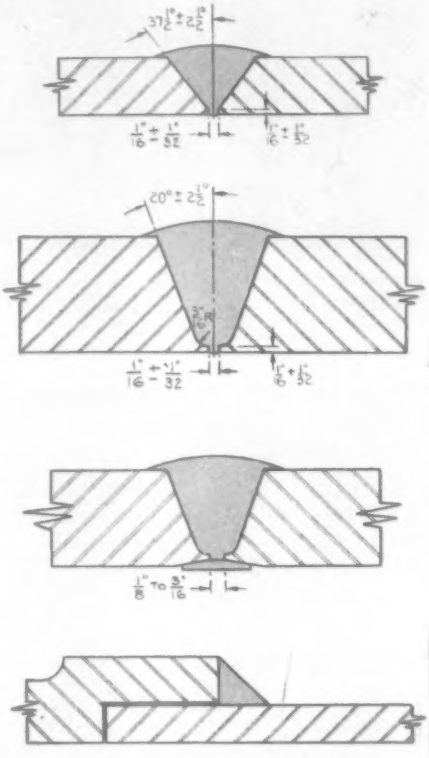


Fig. 3—Welding grooves for piping. Top to bottom: butt weld for ¾-in. wall thickness and less; butt weld for wall thickness above ¾-in.; butt weld with tapered backing ring; fillet or socket weld

the high-temperature physical properties of the parent metals.

Although not used to any great extent, chromium steels can be successfully welded by the atomic-hydrogen process. The hydrogen atmosphere surrounding the arc stream aids in reducing the oxides, and, since there is no carbon present in the flame no carbon pick-up is encountered; in fact, a reduction in carbon content is generally experienced. Sound welds having good ductility after heat treatment can be made on these alloys, although the process lends itself best to pipes of lighter wall thickness. Single-vee butt joints and fillet or socket joints (see Fig. 3) are recommended, but welding should preferably be done in the downhand position. Preheating to about 400 F is necessary, but this is usually adequately supplied from the heat of the arc and the hydrogen flame. Stress relieving or heat treatment is covered in a later paragraph.

Metal-Arc Welding

Metal-arc welding, no doubt, is the most preferred method of welding for all of the chromium-molybdenum alloys as most specifications by engineering firms and users of piping equipment specify arc welding for both power and oil refinery construction. Fig. 7 shows a typical piping assembly being arc welded.

Coated electrodes are available for most of the chrome-moly alloys and generally give deposited weld-metal analyses to match those of the parent pipe materials. Some loss in chromium occurs in the arc, and this is compensated for in the majority of electrodes by the core analysis and electrode coating. The coating usually contains fluxing agents to dissolve the chromium oxides and avoids carbonaceous materials. The use of low-carbon core wire aids further in keeping the carbon content of the weld deposit to the minimum.

Generally, the technique in making chromium-molybdenum arc welds is to maintain a relatively short to medium-short arc length, but the length of arc will vary depending upon the grade of alloy and type of coating employed. Too long an arc does not permit adequate protection against oxidation of some of the chromium. The welding current, as a rule, should be slightly lower than that used with mild steel, particularly on the first to second passes. Again, this will depend upon the alloy, type of coating and the operator's ability to carry high welding heats. Excessive heat combined with long arc length causes "boiling" of the weld metal with resulting porosity.

In filling weld craters, caution should be exercised to avoid crater cracks. It is advisable to grind all improperly formed craters before depositing the next successive bead. It is also good practice to grind the first two layers of weld metal to a relatively smooth finish. Since most of these alloys are air-hardening, any defects that appear in the weld deposits should be removed by grinding rather than

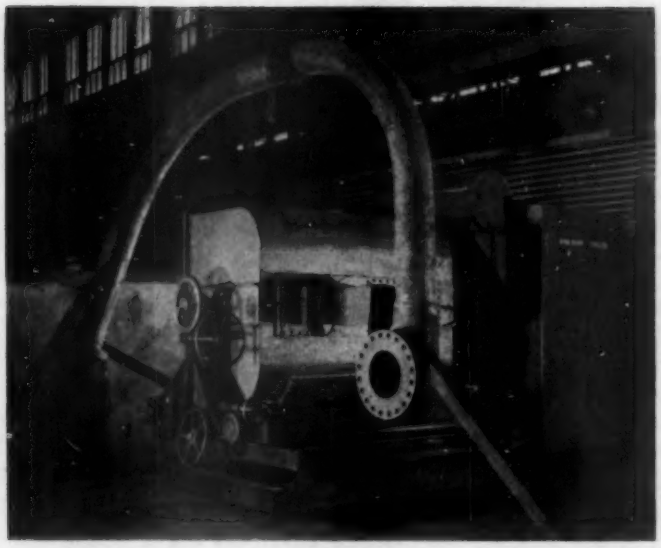


Fig. 4—X-raying a welded joint on a steam turbine pipe bend. Radium is also used, particularly in the field

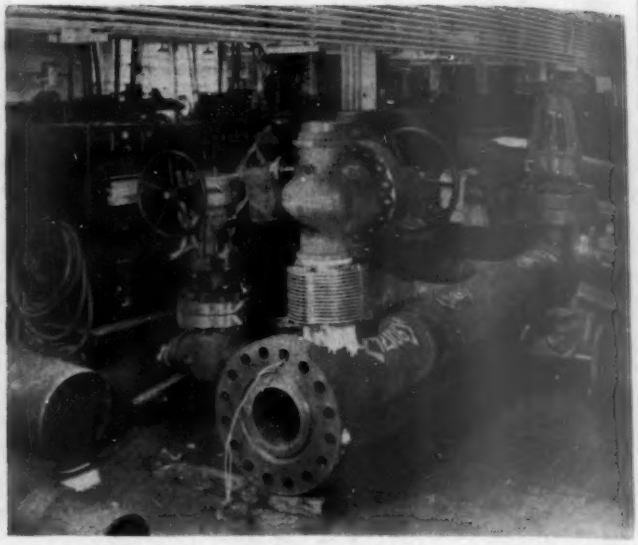


Fig. 5—Stress relieving a welded joint (induction heating) between a valve and a fabricated header assembly

by chipping. Good fit-up between the parts to be joined is advisable as it will aid operators in obtaining the best results with the rather exacting welding techniques required.

The types of welding grooves recommended for arc welding are the single-vee butt joints without or with backing rings, and fillet or socket joints. Refer again to Fig. 3. Electrodes used are generally smaller sized than those employed on plain-carbon steels and seldom exceed 3/16 in. in diameter. Welds can generally be made in all positions (see Fig. 6).

Welding Dissimilar Metals

Occasionally, it is necessary to join chromium-molybdenum steels to dissimilar metals such as carbon and carbon-molybdenum steels or to chromium-nickel stainless steels. When welding chromium-molybdenum to carbon steel, mild-carbon steel electrodes conforming to AWS-ASTM Specification A-233 Grade E-6010 or chromium-molybdenum electrodes matching the alloy can be used. However, if the carbon-steel pipe is Grade "B" material, in which the carbon content may be above 0.20% C, it is advisable to avoid chromium-molybdenum electrodes because drastic air-hardening occurs when the carbon exceeds 0.20% with chromium contents above 1.00%.

Chromium-molybdenum steel can be welded to carbon-molybdenum employing either carbon-molybdenum Grade E-7010 electrodes or chromium-molybdenum electrodes of similar analysis to the base metal, as the carbon content on carbon-molybdenum pipe is generally not too high to cause trouble. For welding a chromium-molybdenum alloy to chromium-nickel stainless steels, 25-12 or 25-20 chromium-nickel electrodes are recommended.

Use of Stainless Electrodes

Sometimes conditions are such that stress relieving or heat treatment on chromium-molybdneum steels after welding is not practicable. Chromium-nickel stainless electrodes may then be employed, but caution should be exercised in their application. Even though the welds are ductile, the fusion zones and heat-affected areas will be brittle, especially with the higher chromium contents. The differences in coefficients of thermal expansion may cause high thermal stresses, and possibly stress corrosion will also be encountered.

Preheating Methods

In arc welding, preheating is a separate operation, whereas in gas and atomic-hydrogen welding it is accomplished by the process itself. Preheating is a very necessary requisite in the welding of air-hardening alloys since it prevents a rapid quench on the weld metal as it is being deposited. The consequent retardation of the cooling rate prevents cracking.

Preheating can be accomplished in several ways; *i.e.*, by oxy-acetylene torches, suitable gas burners, electric induction coils (Fig. 8) or resistance coils. The minimum prescribed temperature is about 400 F, although some authorities recommend 300 F while others specify 800 F and even higher. The writer believes that 400 F is a good practicable temperature as satisfactory welds are produced under such conditions without too much discomfort to the welding operators.

No matter what method is used, preheating should be gradual and uniform, and the temperature should be maintained during the welding operation. The temperature can be checked by means of heat-indicating pills or sticks, surface pyrometers or thermocouples.

Postweld Heat Treatment

Heat treatments of weldments in these alloys consist of: (1) normalize and draw, (2) anneal or (3) stress relieve. The treatment to be used will depend upon where the fabrication is made (shop or field), furnace equipment and the type of alloy involved. If the weldment is shop-fabricated, full furnace heat treatments are generally preferred. This is not always feasible, especially where valves are to be welded into a piping assembly. In such a case, the valve operating mechanism might be damaged by furnace heating, and so local stress relieving is resorted to. Also in field erection of piping,

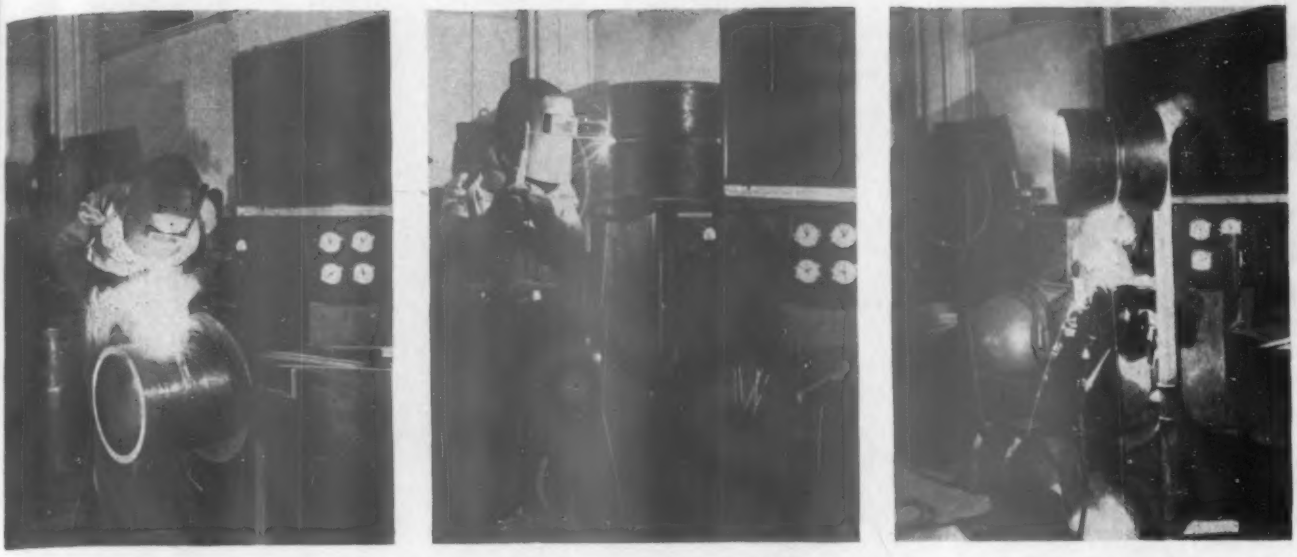


Fig. 6—These operators are making their qualifying tests on butt welds. Left to right: horizontal rolled position (flat weld), vertical fixed position (horizontal weld) and horizontal fixed position (vertical and overhead welds)

the only method of heat treatment is a local stress relief.

Normalize and draw consists of normalizing at 1,600-1,800 F followed by air cooling. Drawing should be done at 1,250-1,425 F, the temperature in both cases depending upon the alloy involved and the physical properties desired. Cooling from the draw may be in the furnace or in the air. Annealing is generally done by furnace cooling after soaking at 1,550-1,650 F.

Stress Relieving

Stress relieving can either be done in a heat-treating furnace or by local means such as gas burners, clamp-on gas-fired furnace, electric induction coils or electric resistance coils. (See Fig. 5.) In field erection, a local means of heating is generally employed to heat a circumferential band containing the weld at the center. The width of the band heated should be at least twice the width of the weld, and beyond this zone the temperature should diminish gradually.

In the treatments previously described, the heating is accomplished above the critical or transformation temperature. In stress relieving, however, the temperature must be below the critical or air-hardening will occur. The temperature selected for stress relieving will depend upon the chromium and carbon contents of the alloy. It is generally desired to select the

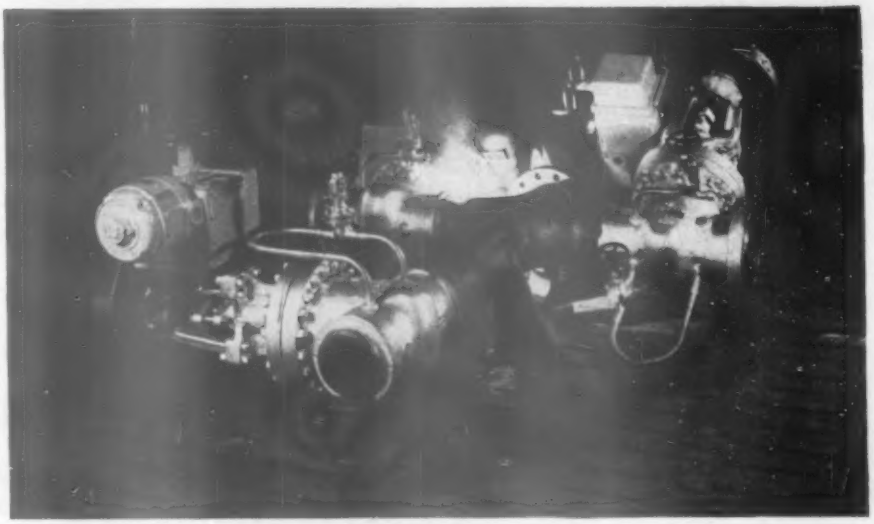


Fig. 7—An alloy-steel valve manifold that is being assembled by welding

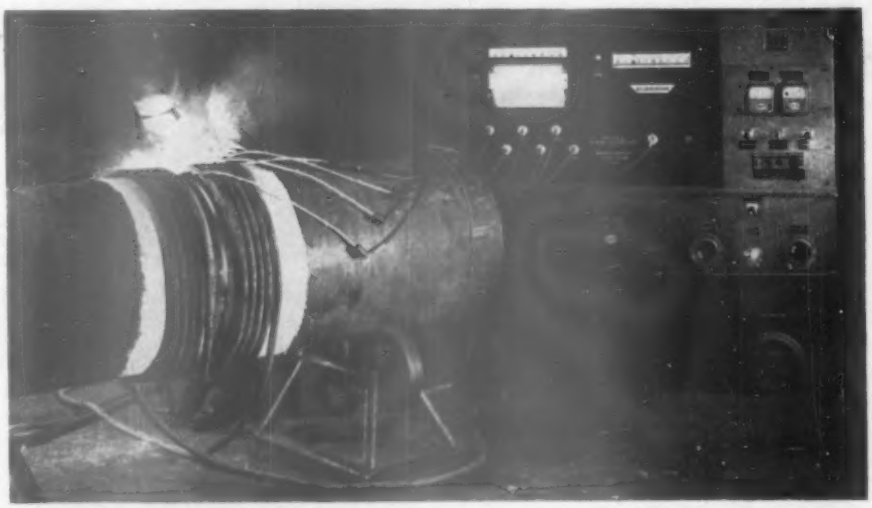


Fig. 8—Preheating by induction during welding. Other methods of preheating used include oxy-acetylene torches, gas burners and resistance coils

highest stress-relieving temperature in order to obtain the maximum softening, but this may not always be possible unless the characteristics of the particular steel are known. A safe range for these steels is 1,300-1,350 F, provided that good control of furnace temperature variations can be maintained. If temperature control is somewhat doubtful, it is recommended that the temperature be lowered slightly or, as an alternative, additional data on the steel be obtained.

In the case of a weldment involving dissimilar metals, it may be desirable to lower the stress-relieving temperature somewhat. As a specific example, the suggested temperature is 1,225-1,275 F for a 1.00% chromium-molybdenum steel pipe welded to carbon-steel or carbon-molybdenum piping. The lower temperature should lower the hardness sufficiently in the higher alloy material and reduce scaling of the latter materials.

Stress-relieving temperature should be brought up slowly and held at the desired point for at least two hours per inch of thickness, but never less than 1 hour. A slow cooling should follow.

Radiographic Inspection

The ASME Boiler Code requires radiographic inspection only on circumferential welded joints on pressure piping above 16 in. nominal diameter and 15/8-in. wall thickness for steam service and above 10 in. nominal size and 1¼-in. wall thickness for water. The ASA Code for Pressure Piping does not require any radiographic examination of welded piping. Recently, however, designing engineers are specifying radiographic inspection of welded joints in steam power piping for high pressure-temperature service, in which service ½ to 2% chromium-molybdenum alloys are often employed.

The radiographic inspection can be accomplished either by X-rays or by gamma rays emanating from radium. X-ray equipment, being bulky, is usually confined to shop work (Fig. 4). Small capsules of radium, ranging in sizes from 25 to 200 milligrams, are employed in field inspection and also used in fabricating shops when X-ray equipment is not available or when welds are so located that X-ray examination is difficult.

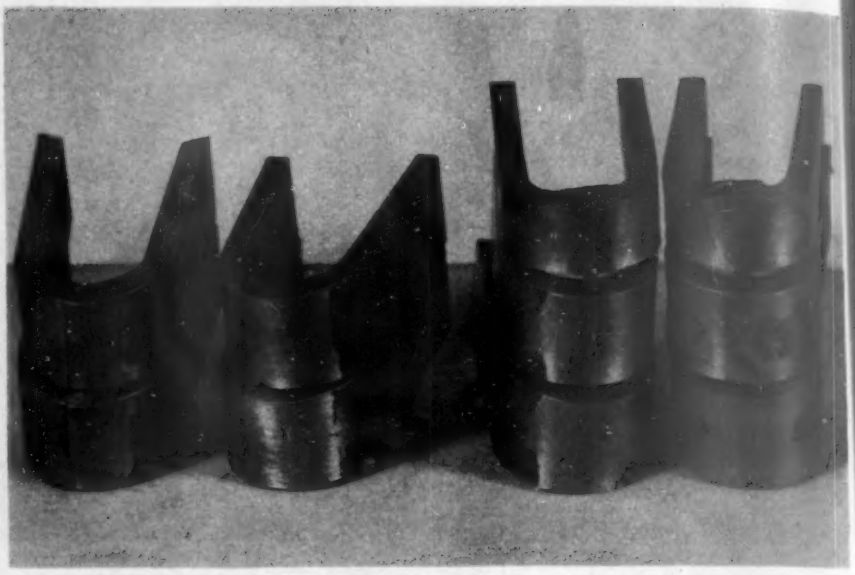


Fig. 9—Typical bend bars of welds made in 1.00% chromium, ½% molybdenum steel. These indicate ductility and thorough fusion of root and side walls

Table 1. Chromium-Molybdenum Steel for High-Temperature Service

Type Alloy, %	Carbon Content, %	Chromium Range, %	Molybdenum Range, %
½ Cr, ½ Mo	0.20 Max.	0.40 to 0.60	0.45 to 0.65
1 Cr, ½ Mo	0.15 Max.	0.80 to 1.10	0.45 to 0.65
2 Cr, ½ Mo	0.15 Max.	1.75 to 2.25	0.45 to 0.65
5 Cr, ½ Mo	0.15 Max.	4.00 to 6.00	0.45 to 0.65
7 Cr, ½ Mo	0.15 Max.	6.00 to 8.00	0.45 to 0.65
9 Cr, 1½ Mo	0.15 Max.	8.00 to 10.00	1.25 to 1.75

☆ ☆

Underwater Induction Heating

A HEAT-TREATING method for underwater tempering of steel surfaces by high-frequency current is now being introduced in Soviet industry on a wide scale, according to an article by Dr. Mikhail Lozinsky in the *Moscow News*. The method consists of immersing in water both the part to be treated and the inductor (induction coil) that will heat it. The water serves to cool the inductor and also helps to produce a surface that is 50-100% more durable than any attained by previous methods.

The underwater inductors can be made small enough to fit easily into a matchbox. The operation is simple: the inductor is immersed in water one or two millimeters (0.04 to 0.08 in.) from the part to be treated, and the current is turned on. Apart from the effect of the 50-100% increase in the hardness of the treated surface, the method is quicker than its forerunner.

"High-frequency tempering was widely used throughout Soviet industry," writes Dr. Lozinsky, "but the problem of cooling the inductor had to be solved before the inner surfaces of tiny holes in gears, bushings, etc., could be heat treated by this method. The miniature inductors had to be made of fine copper wire and melted almost immediately.

"Just at that time I happened to run across a magazine which described underwater repairs to ships' hulls by oxy-acetylene welding. This gave me the idea of heat-treating under water. Water is a poor conductor of electricity, and hence the loss of current through it could not be great. Moreover, steam, which was bound to form at the surface being heated, is a poor conductor of heat, so that the loss of heat would also be small. The inductor, on the other hand, would have a perfect cooling system."

★ MAINTENANCE

HARD-FACING, Antidote for Wear

BY FRED M. BURT

Hard-facing is industry's best weapon against wear. Too little is known about the fundamental facts of what hard-facing will do to extend the service lives of parts subjected to abrasion and impact.

A GREAT variety of parts of machines and other equipments are made from hard steels of special alloys to resist wear. Especially severe wear occurs on parts that are unlubricated and constantly called upon to withstand harsh abrasive action or heavy impacts. When such parts wear down to the point where they will no longer perform their functions, they are replaced. This, however, is frequently wasteful. The main body of a part made of a costly alloy may be sound and intact, even though the part as a whole is of no further value because its fit or dimensions have been distorted by wear.

The right answer is hard-facing, which brings the part back to the original shape and dimensions and with a harder-than-original surface. A hard-faced part often has many times the service life of a duplicate new part.

IN THE PETROLEUM INDUSTRY

The earliest uses of hard-facing were found in the petroleum industry, so let us first inspect a few applications there. It won't take much imagination to visualize the results that would come from using the same principles of hard-facing on parts of equipments used in other industries.

First, let us watch a hard-facing procedure that has greatly extended the lives of drag bits and seismograph bits that must delve deeply below the surface of the earth. The blades of the drag bits were made from a carbon-molybdenum drop-forged steel (SAE 4140). In the first step, an oxy-acetylene torch is used to tack a cobalt-tungsten-carbide insert on the blade. The insert is picked up with a high-tensile rod for positioning on the blade as shown in Fig. 1. The face of the blade is heated to a molten plastic condition, and the insert is sunk at the desired spot in the molten puddle, and welded in place with the high-tensile rod.

Fig. 2 shows the desired positions of several of these inserts. The reaming edges are thus protected in order to help maintain a square corner and keep the edges out to gauge. This procedure is called a special dress.

The next step is to apply an overlay of 10-20 mesh tungsten-carbide to the entire faced area and reaming edge. The oxy-acetylene process is used with fabricated hard-facing rods composed of particles of tungsten-carbide and mild-steel strips. This rod is manufactured by feeding particles onto the strip and rolling the latter into a cylindrical container. The rod is thus a steel sheath packed with tungsten-carbide particles—a sort of hard-facing cigarette. A final smoothing-out layer of 20-30 mesh tungsten-carbide completes the hard-facing operation. In Fig. 3, the blade at the left has the inserts sunk in place, and the one on the right has been given its final smoothing out.

The blades are heat treated to 300-360 Brinell hardness and then welded to the head or body of the bit as shown in Fig. 4. Worn blades cut from the body of the bit with an oxy-acetylene torch may be seen in Fig. 5. Note how the inserts have kept the edges out to size, forming sharp, serrated fingers to produce better cutting action. The whole hard-facing procedure extends the service life of a

Fig. 1—Positioning a cobalt-tungsten-carbide insert on the blade of a drag bit

Photos and drawings courtesy the Stoody Co.

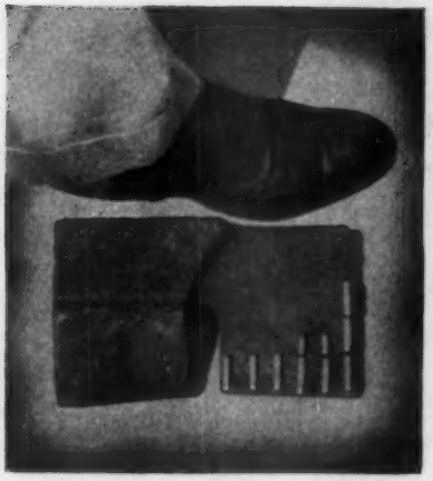


Fig. 2—This is how the blade looks when all the inserts are in place

Fig. 3—Inserts are overlaid with tungsten carbide (left) and smoothed

Fig. 4—The bit as rebuilt for longer service in the earth's interior

drag bit to many times that which might be expected without this hard coating.

The slush tubes in Fig. 6 are used as bushings in drill bits to keep the drilling mud from washing out the parts. When a bit is rebuilt, the worn slush tube is cut out with a torch, and new inserts of special hard alloy are welded in. Slush tubes need to be lined with inserts highly resistant to abrasion as the mud passing through them at high velocity will wear out unprotected metal in a very short time.

Hard-Faced Tool Joints

The tungsten-carbide particles may also be applied by arc welding, using a special electrode prepared in the manner described above. Good examples of this application are the tool joints shown in Fig. 7. After drilling eight holes 6,000 ft deep, a total of 48,000 ft, one such set of joints was calipered. No joint showed a wear loss of more than $\frac{3}{16}$ in. on the diameter, and wear was found only where the joints make up. Note in Fig. 8 the squareness of the elevator shoulders. This condition is highly desirable to the oil man since the entire weight of a drill string, often two to three miles or longer, must be supported on a single shoulder. Although the hard-facing was almost worn away after the long run of 48,000 ft, there was practically no wear on the joint itself. Since the taking of this picture (Fig. 8), the joints have been hard-faced again and are hard at work. This cycle of drilling and consequent wear, then hard-facing and back to drilling will occur time and again. In contrast to these hard-faced joints, unprotected joints were worn $\frac{1}{2}$ in. after five wells or a total of 30,000 ft.

The application of hard-facing is simple on used joints or new joints where a slight oversize is not undesirable. Here is the detailed procedure:

(1) Preheat work to 300-400 F.

(2) Weld box to pipe.

(3) Run a circumferential bead of high-carbon steel $\frac{1}{8}$ in. back from the shoulder.

(4) Space a second bead of high-carbon steel $1\frac{1}{2}$ to 2 in. from the first one.

(5) Fill in the space between the two high-carbon steel beads with $\frac{3}{16}$ or $\frac{1}{4}$ in., 20-30 mesh tungsten-carbide electrode. A weaving motion is used to make the deposit.

Where it is desired to hard-face new joints or resleeved joints without any oversize, the following method is used:

(1) A recess $\frac{1}{8}$ in. deep by $1\frac{1}{2}$ in. wide is cut in the elevator shoulder.

(2) The work is preheated to 300-400 F.

(3) The recess is filled with $\frac{3}{16}$ or $\frac{1}{4}$ in., 20-30 mesh tungsten-carbide electrodes.

Hard-facing is frequently used in the oil industry, principally on the following products and in quantities about in the order named:

(1) bits, (2) tool joints, (3) wash pipes, (4) ditcher teeth, (5) sheath tubes, bushings, (6) mud pumps. It is also used on hot oil pump sleeves, valves and valve seats, clutch plates, pipe-cleaning knives, core catchers, reamers, washover shoes, bailer bottoms and many other parts.

Roller Guides for a Steel Mill

A typical use in the steel industry is the hard-facing of roller guides. These guides are mounted ahead of the mill

Fig. 5—Worn blades cut from the body of a bit to be reconditioned. Note the worn edges between the inserts

rolls to keep the hot bars in alignment as they are being rolled. The guides shown in Fig. 9 were used in rolling 1¾ to 2½ in. rounds in 12 and 14 in. bar mills.

To rebuild the worn surfaces, a special tungsten-cobalt-chromium rod was applied by the oxy-acetylene process. The first step was to preheat the guide to 400-500 F in order to eliminate pinholing. The procedure is detailed in Fig. 9: hard-facing was applied first to the lower half of the roller, then the upper. After all of the new metal had been deposited, the rollers were ground down to a finish size that left a ⅛-in. final depth of deposit. The cost complete, including grinding, was about $75 per set of six rollers.

This particular set of guides was removed from the mill in order to determine the amount of wear after the rolling of 3,000, 6,000 and 10,000 tons. Observations indicated that at least 15,000 tons could be rolled before resurfacing, a performance of about double that given by other grades of hard-facing tested and many times the service of guides not surfaced.

Worn Engine Valves

In the average maintenance and repair shop for truck fleets, engine valves are generally saved. There is good reason for this practice. As a general rule, from 70% to 80% of the worn valves can be salvaged by hard-facing for an additional 50,000 to 75,000 miles of service. However, all cracked, greatly undersized and sodium-filled valves should be discarded.

The valve to be hard-faced should be chucked in a small bench lathe for removal of the hard scale with a round-nosed tool. A machined concave recess (see Fig. 10) makes it easier for the weldor to apply the hard-facing and eliminates danger of burning the extreme edge. The outer edge of the valve is not machined since this shoulder furnishes support for the hard-facing deposit and prevents the torch flame from burning away the thin edge and reducing the valve diameter.

A recommended hard-facing for this purpose is a tungsten-cobalt-chromium alloy characterized by self-hardening deposits of 390-415 Brinell hardness. These rods are supplied only for oxy-acetylene application. It is advisable to use an adjustable motor-driven fixture (see Fig. 11) so that the valve can be turned slowly during the hard-facing operation. A 5/32-in. rod should be used with a torch tip one size larger than that used on mild-steel rods of the same diameter. The flame should be definitely carburizing with the acetylene envelope about three times the length of the inner cone. The high spots can be machined down in a lathe or simply ground to the required finish and bevel in a standard valve grinder.

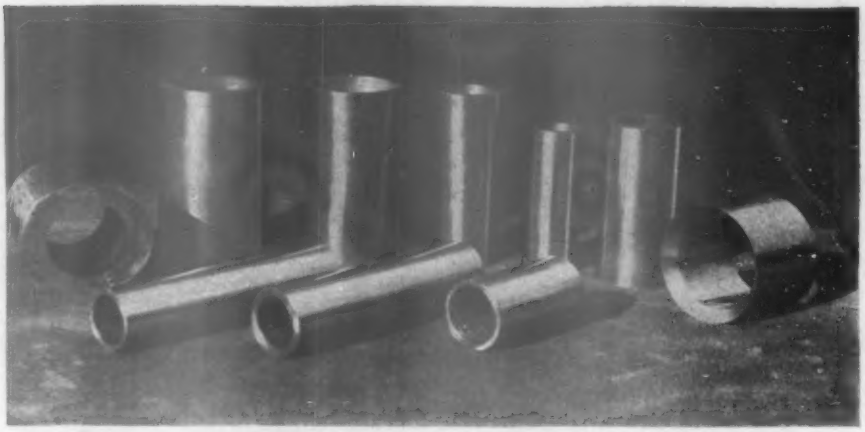


Fig. 6—Slush tubes (used as bushings in drill bits) must be lined to resist the mud pumped away from the blade cuttings

Fig. 7—A set of tool joints to which a tungsten-carbide hard-facing has been applied by arc welding, using a special electrode

Dies and Punches

Many dies and punches are subjected to heavy-duty work requiring great resistance to heat, abrasion and impact. Hot-trimming dies, hot-piercing punches, cold-punch dies and other steel mill units, also a great variety of dies used in pressing refractories and other heavy clay products into shape, can be hard-faced for longer service lives renewable as often as desired.

In fabricating parts for bridges, shipyards and the construction industry, a large iron works cold punched and sheared mild steel up to ½ in. thick. The finest oil-hardened tool-steel dies obtainable were used, but even these failed through chipping and breakage. They were salvaged by hard-facing and gave over twice the life of unfaced dies. Chipping was overcome, and the dies are now hard-faced whenever necessary.

Refractories used in steel furnaces, chemical plants, oil refineries, cement mills, ceramic plants, etc. are made in a variety of intricate shapes by feeding the refractory clays in a semi-dry condition into dies and presses. Many of the dies are so irregular in shape that they cannot be made of tool steel because of the warping and hardening hazards. Such dies can be made of ordinary 1020 steel and then hard-faced, supplying hardness and wear resistance without heat treatment.

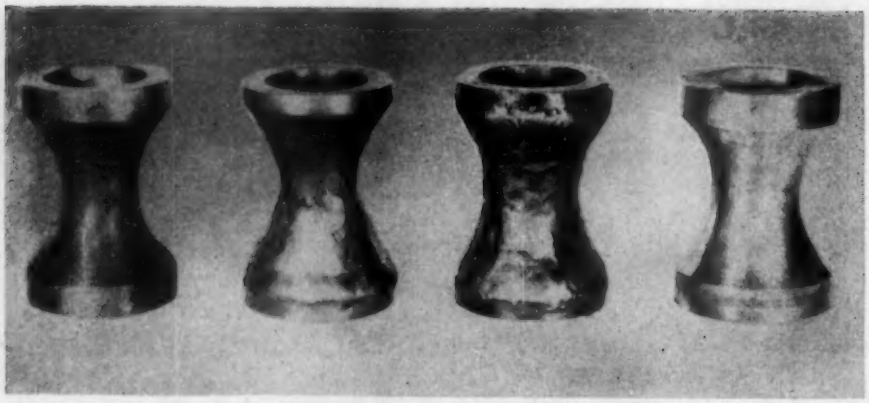


Fig. 9—Steps in the hard-facing of roller guides for a steel mill. Left to right: Roller as worn; hard-facing applied to lower half; roller completely hard-faced; roller finish ground and ready for installation

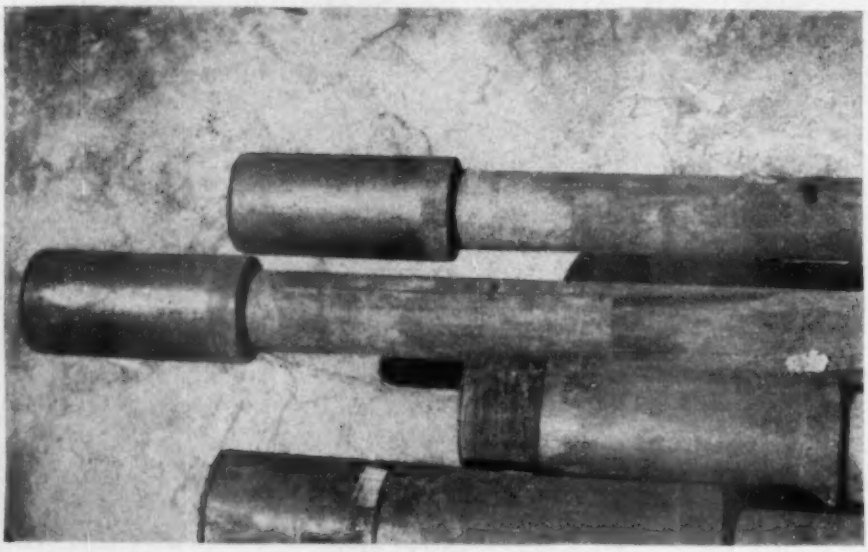


Fig. 8—Tool joints after drilling a total of 48,000 ft. The only wear is where the joints make up. Note squareness of elevator shoulders

When the wear is on the corner or edge, a fabricated hard-facing rod composed of mixed alloys in a mild-steel sheath is applied. The deposit can be peened while hot to an approximate shape to reduce grinding. When the wear is on the surface of the die, another type of hard-facing is applied by either the arc or oxy-acetylene process. Service records show that unfaced dies were worn so as to be no longer usable after turning out about 10,000 pieces. Hard-faced dies, operating on the same machine at the same speed and processing the same refractory material, turned out more than 340,000 pieces; then they were touched up, reground and again run for the same production. The ratio of about 30-to-1 has been found to hold true in most hard-faced vs. unprotected dies.

Teeth for Ditch Diggers

Ditch digger teeth (Fig. 12) cut down through the earth's surface to depths ranging from three feet to as much as 18 feet. Some earth formations wear out unfaced teeth in as little as two weeks. Hard-faced teeth, however, last as long as 20 to 30 weeks —10 to 15 times as long. On these teeth, the fabricated rod holding tungsten-carbide particles (20-30 mesh) is applied by the oxy-acetylene process. The hard metal should be from $\frac{1}{16}$ to $\frac{1}{8}$ in. thick and extend back about 2 to 3 in. from the cutting edge. These teeth can be resurfaced time and again if not allowed to wear down too far. The procedure is as follows:

(1) Place the blade on a $\frac{1}{4}$-in. copper plate and mark an outline of the original size with soapstone.

(2) Build up the worn area with a $\frac{1}{4}$-in high-carbon-steel electrode or welding rod.

(3) Using the fabricated tungsten-carbide rod, hard-face the leading face of each tooth 2 to 3 in. up from the cutting edge.

(4) Finish grind the opposite side to a sharp edge.

Other hard-facing applications are made on the sprockets, rollers, tracks and idlers of ditch diggers.

The foregoing examples are but a few of many that prove the great advantages of the use of hard-facing. It is only common sense to analyze the type of wear on a particular part to determine the proper application of the right hard-facing. If there are any doubts, it is easy to get an authoritative answer from a hard-facing manufacturer's representative.

Much progress is being made towards establishing standards in hard-facing, and more and more specific technical information is being made available to aid users and potential users to determine the best type of hard-facing for any particular job and how best to apply the material.

Four Basic Alloy Types

Hard-facing materials may be conveniently divided into four common types: (1) less than 20% alloys, (2) more than 20% alloys, (3) non-ferrous alloys and (4) tungsten carbides. The hardness of the first three groups varies only 15 points on the Rockwell C scale, yet for a specific application one type of alloy may outlast the others by as high as five to one. Obviously the slight difference in hardness isn't the only answer.

The first three groups usually rely upon chromium as the essential wear-resistant ingredient. Chromium, though excellent for resistance to corrosion and strength at high temperature, is not so resistant to abrasion as tungsten or molybdenum. Most hard-facing materials are high in carbon, 1% to 4½%. The primary purpose of the carbon is to convert as much of the alloying metals as possible into hard carbides while still retaining the properties of impact value, weldability and ease of manufacture.

Tungsten carbide possesses the greatest hardness, but it is brittle and has no impact value. Tungsten carbide, moreover, cannot be used as the basis of a homogeneous hard-facing rod because it has been found to be impossible in such a rod to maintain enough of the tungsten in a carbide condition. This is because of the ex-

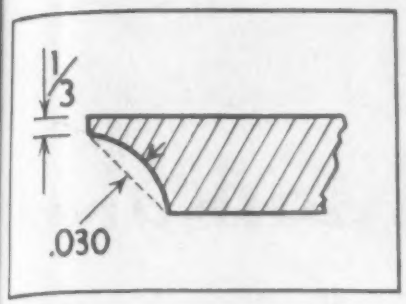


Fig. 11 (right)—Jig for hard-facing exhaust valves. A—cover; B—motor; C—swinging table; D—valve clamp; E—valve held in position; F—belt and pulleys; G—hinges; H—shaft bracket; I—¼ in. shaft; J—adjusting arm; K—frame; L—asbestos plate 1 ft square; M—foot switch

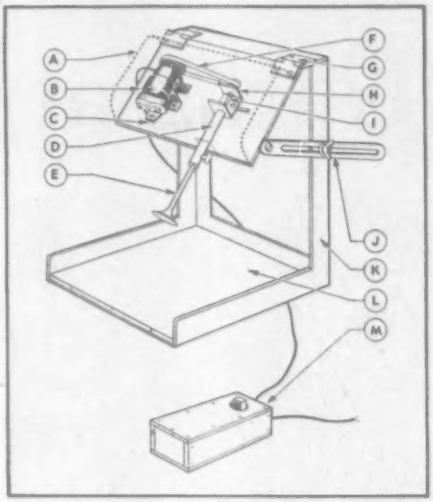
treme solubility of tungsten carbide in molten metal baths.

Molybdenum carbide, though nearly as wear-resistant as tungsten in the pure carbide form, also has high solubility. Chromium carbide avoids this difficulty, though it is only about 75% as wear-resistant as tungsten carbide. However, chromium carbide is superior in wear resistance to manganese and iron carbides. It is fairly easy to weld, and it will alloy in all proportions and still maintain many of the carbide properties. Chromium carbide is also easily manufactured in quantity.

Under 20% Ferrous

Group I alloys have a ferrous base and rely on chromium for wear resistance. Generally substantial additions of manganese and silicon are made to bring the total alloying material from 7% to 15%. These alloys are forgeable at high temperature but cannot be cold-worked; they are nonmachinable and will acquire a high polish. Group I alloys possess the greatest resistance to impact. They are more resistant to corrosion than 1050 steel but do not contain enough chromium to be considered stainless. At temperatures over 500 F, this group of alloys is subject to relatively rapid oxidation. The as-deposited hardness (with either the arc or oxy-acetylene process) is approximately 50 Rockwell C, the same as heat-treated 1050 steel. Wear resistance, however, is about three times that of 1050 steel.

Fig. 10 (left)—The proper way to machine the edge of an engine valve in preparation for hard-facing



Over 20% Group

Group 2 alloys have from 18% to 35% chromium and may also contain manganese, silicon, molybdenum, cobalt and/or vanadium. Total alloy percentages vary from 25% to 55%. Hardness ranges from 55 to 62 Rockwell C, so these alloys can be finished only by grinding and can't be worked or forged at any temperature. Their wear resistance is 10 to 15 times greater than SAE 1050 and they have all the advantages of stainless when in contact with corrosive media. Group II alloys have a minimum of impact resistance so they must be supported by adequate base metal. They cannot be heat treated.

Non-Ferrous Alloys

Group 3 alloys also have a chromium content of 20% to 30% but have little or no iron. These nonferrous alloys are produced in several types for various conditions of heat or corrosion, the difference principally noticed being in the hardness and impact resistance. One alloy in this group has a Rockwell C hardness of 43 and is machinable with carbide tools. Another alloy has a 54 hardness and is not machinable. Impact resistance in the lower hardness range compares roughly with the less than 20% alloys, while the harder alloys have about the same impact resistance as those in Group 2. The wear resistance of Group 3 alloys is from 10 to 15 times greater than plain-carbon steels. They have exceptional flowing qualities when applied by the oxy-acetylene method but are not as adaptable to arc application as Group 2 alloys.

Tungsten Carbides

Group 4 hard-facings are based on tungsten carbide. This compound is manufactured by simply melting tungsten and carbon together and casting the resulting alloy into the desired shapes. It has a hardness far in excess of any of the alloys in the first three groups but cannot be used in the cast form for welding purposes because of its brittleness. It is therefore necessary to incorporate small particles of tungsten carbide in steel tubes so that some of the properties of the steel tubing are imparted to the deposit to increase its impact strength. Tungsten-carbide deposits are nonmachinable, and accurate finish grinding can be done on them only with diamond wheels. They can, however, be heat treated. Wear resistance is at least 30 times as great as 1050 steel.

When selecting hard-facing materials, one should not be unduly influenced by the factor of hardness. Hardness alone is not even the ultimate determinant for abrasion resistance, and other qualities such as resistance to erosion, corrosion, heat impact and thermal shock may be even more desirable for some applications.

Fig. 12—This giant machine is used to dig the ditches in which oil pipe lines are laid. Its hard-faced teeth will last from 10 to 15 times as long as they formerly did

★ CONSTRUCTION

Radiant Heating at Kankakee

BY CLYDE B. CLASON

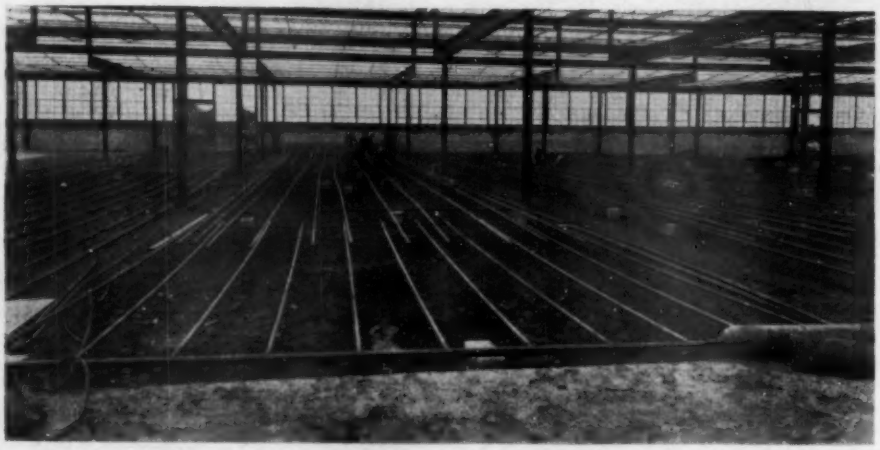


Fig. 1—Wrought-iron pipe grid using short 2-in. headers (20 ft) and long 1¼-in. laterals (140 ft). This is the most common type of construction

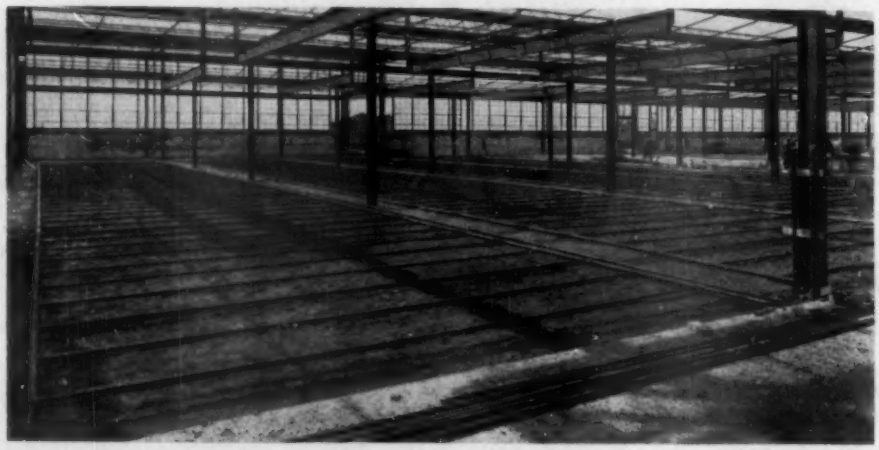


Fig. 2—Grid construction using short 1¼-in. laterals (20 ft) with long 2-in. headers (140 ft). This is the type of construction originally planned

Another big opportunity for welding is provided by radiant heating. This article describes a pioneer installation that includes 40 miles of wrought-iron pipe and 25,000 ft of copper tubing to be joined.

A GIANT experimental laboratory on radiant heating will be furnished by the new water-heater manufacturing plant of the A. O. Smith Corp., now nearing completion at Kankakee, Ill. The radiant heating system in this modern 83¾-acre plant is the largest on record, consisting of some 40 miles of wrought-iron piping, 25,000 ft of copper tubing and 8,000 ft of Bundy tubing arranged in both grids and continuous coils. This vast network of piping is to be permanently sealed within the concrete floor slabs or in the ceilings. Through it there will circulate 15,000 gallons of water 12 times every hour—a total circulation of 180,000 gph.

This large amount of circulating water will be heated by 120 individual Smithway-Burkay volume water heaters operating on natural gas. These will maintain the temperature of the ground floor slabs at about 85 F, thus insuring an average working temperature of about 65 F throughout the building. An elaborate system of thermostats has been designed to respond with great sensitivity to changes in the outdoor temperature.

Largely of one-story construction, the new Kankakee works of A. O. Smith Corp. measures some 1,200 ft long by 315 ft wide. In addition to the ground floor area of 381,750 sq ft, there is a mezzanine floor for laboratories (10,650 sq ft) and first and second floor office space totaling 22,788 sq ft. The 1,200-ft length of the ground floor is divided into forty-eight 25-ft bays, each running entirely across the 315-ft width. Two heaters are needed to take care of the heating requirements of one bay, each heater serving panels which cover half a bay.

A Flexible System

The advantages of such a heating system are numerous. C. W. Colby, designer of the plant's radiant heating system and engineer in charge of its installation, believes that it will cost less to install and will operate at greater efficiency than any type of centralized heating. It needs no expensive boiler house with a stack towering 120 feet or more, no high-pressure steam boilers, no licensed engineers operating in three shifts. Instead, the whole vast heating system can be serviced by a single man, working one shift, who needs to be acquainted only with the workings of one small and comparatively simple type of water heater.

Fig. 3—Here 2-in. wrought-iron pipe is used in a combination of grid and continuous coil construction that provides a concentration of radiant surface at the outside wall

Fig. 4—Experimental continuous coil of 2-in. wrought-iron pipe spaced on 36-in. centers. This is to be used to determine rate of heat transfer

Fig. 5—Grid of ⅝-in. Bundy tubing in the mezzanine floor, southeast corner. The loops are approximately 100 ft. long, spaced from 6 to 12 inches

Since this radiant heating system is in reality 120 separate systems, there is obviously great flexibility. The heat in any particular area of the plant can be turned on or off or regulated to any desired temperature. No serious heating problem arises if a bay or two must be shut off because of floor rearrangement. Any single area can be heated with peak efficiency, even though the rest of the plant is not in operation.

Radiant heating is expected to contribute materially to the cleanliness of the Kankakee plant. Dust will be at a minimum because sealed-in grids and coils cannot cause air agitation. A dust-free atmosphere cannot help but have its effect upon the health conditions of employees. Furthermore, the new system will contribute to the physical efficiency of the plant by offering less interference with conveyor lines, overhead cranes, etc.

An Engineering Laboratory

All of these factors undoubtedly contributed to the management's decision to use radiant heating, but the unparalleled opportunity for research was by no means a minor contributing cause. Believing that the company would be remiss if it ignored this opportunity to make a contribution to basic heating knowledge, the management instructed engineers concerned to take full advantage of the chance afforded them to discover answers to problems which have hitherto proved baffling. Various combinations of grids and coils were designed with the thought of experiment in mind.

As stated in the opening paragraph, the piping used consists of wrought iron, copper and steel (Bundy tubing). Resistance to corrosion is of extreme importance, obviously, for once a grid has been embedded in a floor slab it is next to impossible to locate and repair a leak in any of its components. For this reason, wrought iron was chosen for the bulk of the piping.

Wrought iron is a composition of relatively pure iron and a glassy slag (iron silicate) uniformly distributed in the form of threads or fibres extending in the direction of rolling. Because of the presence of this non-rustable slag, amounting to about 3% by weight, wrought iron is able to offer a remarkable resistance to the corrosive action of hot water. Furthermore, it is as readily weldable as mild steel, although the fusion temperature is somewhat higher and certain modifications of both gas and arc welding techniques are necessary.

Wrought-Iron Grids

Eighty per cent of the ground floor installations is of grid-type construction, consisting of headers and laterals of wrought-iron pipe varying in diameter from 2 down to ¾ in. A typical grid (Fig. 1) consists of short 2-in. headers (20 ft) and long 1¼-in. laterals (140 ft). The laterals are fabri-

(*Please turn to Page 60*)

Fig. 1—Servel refrigerator assembly on the final conveyor line

Fig. 2—Examining a UR-800 unit are W. R. Campbell (right), superintendent of the Servel refrigerator unit division; H. C. Kaufman, general foreman of unit welding, and C. E. Deig, foreman of welding

An extensive conveyorized production line for oxy-acetylene welding is something of a rarity, but several such lines may be found at the 71-acre plant of Servel, Inc., Evansville, Ind. Who said gas welding isn't a production process?

Servel Gas Welds

"THE future belongs to those who prepare for it," Louis Ruthenburg, president of Servel, Inc., constantly emphasized to his engineering, tooling, production and sales organization during the war years. "There will come the time when we can return to wealth-producing usefulness. Let us be ready at a moment's notice."

The organization was ready on V-J day. Fifteen minutes after receiving termination telegrams, Servel reconversion had begun. By mid-January, gas refrigerators were pouring from two assembly lines at a rate of 95% of full capacity.

Planning Peace Program

All department heads met regularly each week during the war period to plan and program postwar production. Much night congregation was required, but they were all there on the trigger on V-J day. Perhaps no other enterprise got into full peacetime production with such dispatch. The reconversion involved complete tooling for such new products as supermetic refrigerator compressors, a full line of automatic gas water heaters, an extensive range of gas all-year air conditioning equipment. In all, some 6,500 machine tools, dies, jigs and fixtures, as well as complete worker training in new skills, were required.

"You can do it better with gas," might well be taken as a Servel production motto. An outstanding Servel achievement was the speedy restoration of its extensive oxy-acetylene welding facilities, largely inactive during the war period.

Servel operates the longest conveyorized welding line on light-gauge tubing to be found anywhere in the world. Because of the currently growing regard for welded tubular construction in many fields such as aircraft, marine, agricultural machinery and metal furniture, I propose to detail the conveyorized oxy-acetylene welding technique quite completely.

To facilitate this article, W. R. Campbell, superintendent of Servel unit and water heater production; H. C. Kaufman, general foreman of welding, and C. E. Deig, foreman of welding, gave me generously of their time. These men are shown in Fig. 2 examining a UR-800 unit. Mr. Campbell has been 20 years with Servel, Mr. Kaufman 18 and Mr. Deig 15. Their long experience working together is one of the company's great productive strengths.

Mr. Campbell, the superintendent of production, is a recognized welding authority. During the war he acted as superintendent of the Servel wing plant, which produced complete wings for the Republic P-47 fighter plane. At one time he had 4,900 skilled workers under his direction.

Leakproof Welds Necessary

As is well known, the Servel gas refrigerator employs the absorption system, which has no moving parts. Energy is supplied by a small gas flame under automatic control. The chief components are the generator, liquid heat exchanger, absorber, condenser, rectifier, gas heat exchanger and evaporator. These parts are connected by an intricate array of seamless tubing of many sizes and shapes with compound bends and contours. The small amount of gas and liquid refrigerant hermetically sealed in the unit is so proportioned that when heat is applied at the generator, cold is produced at the evaporator.

"The most essential factor to the uninterrupted operation of the unit," Mr. Campbell pointed out, "is permanent tightness of all joints. The smallest leak will quickly lower the efficiency of the unit, stopping its action completely. This means that the unit must not only be welded with greatest care, but it must also be carefully tested for leaks after welding. The fluids and gases under pressure

Gas Refrigerators

BY GERALD ELDRIDGE STEDMAN

include hydrogen gas, ammonia and water, so the system of testing must be such as to detect the most minute pinhole."

Some 140 welds must be made in the assembly of a model UR-800 refrigeration unit. Fig. 3, showing the many varied parts and tubes to be joined, gives a clear idea of the unusual complexity of weldments involved. Some data of interest are:

Total number of parts per unit: 1,149.

Number of pieces of tubing: 54.

Length of tubing: 108 ft 7 22/32 in.

Welding rod required: 1½ lb.

The seamless steel tubing to be joined ranges from ¼ to 4¾ in. OD and from 12 to 17 gauge in wall thickness. The material roughly agrees with SAE 1010 steel, having an analysis of carbon 0.16% max, manganese 0.25-0.60% max, phosphorus 0.05% max, sulphur 0.05% max, silicon 0.20% max and copper 0.15% max.

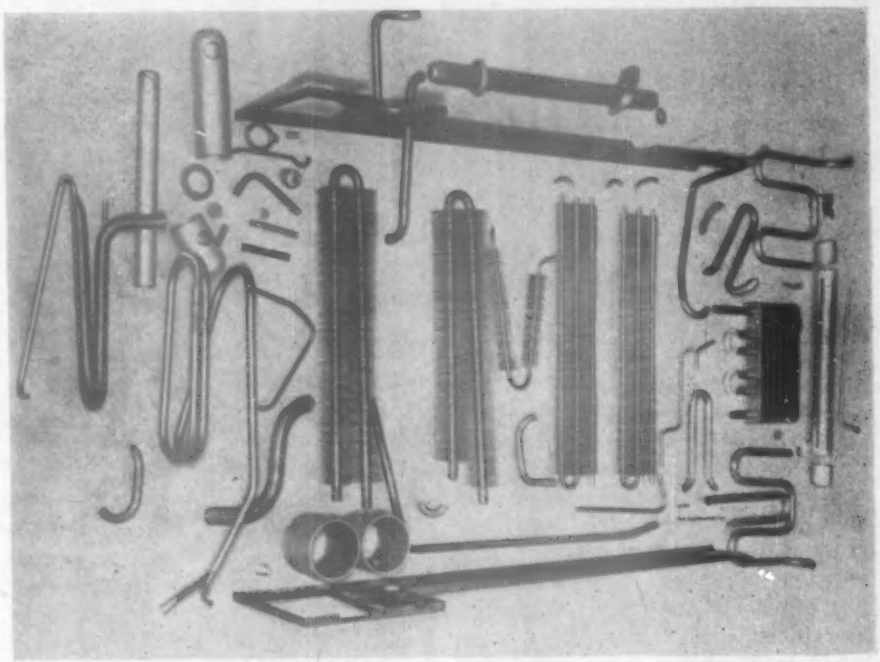
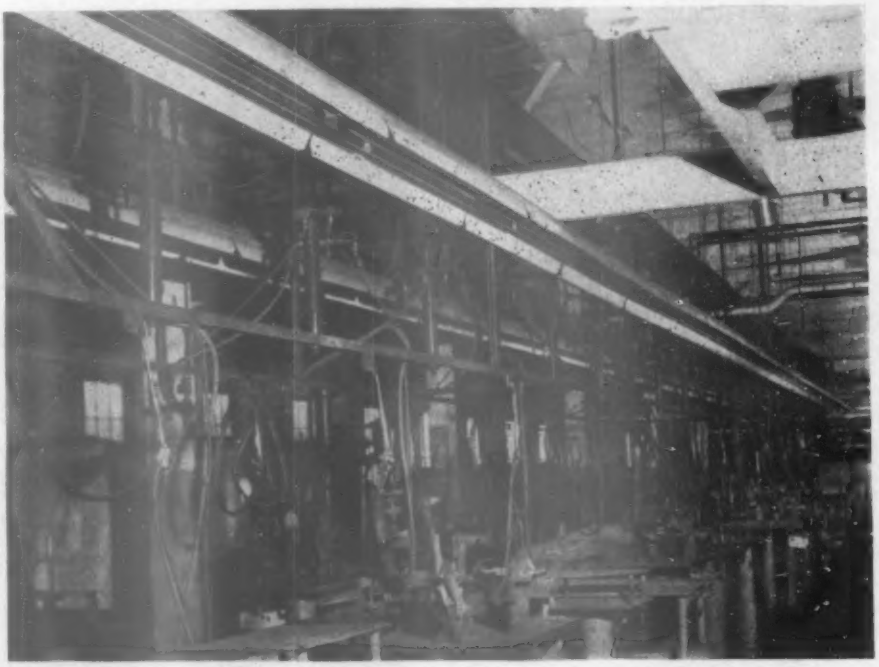


Fig. 3—Some 140 welds must be made in order to form a complete Servel refrigeration unit. Above are the many varied parts and tubes to be welded

Fig. 4—Part of the over 12,000 ft of acetylene and oxygen pipe lines servicing Servel's welding department. There are 150 two-torch welding stations



Tubing Production

After being severly cold worked on tube reducers, all of this tubing is bright annealed in a controlled-atmosphere continuous electric furnace in order to eliminate scale formation and to win a maximum tensile strength of 55,000 psi. This subcritical annealing imparts a nominal hardness on the order of 50 Rockwell B. Each reduction is annealed. Thereafter the tubing goes to extensive cutting, forming, bending, drilling, fabricating, cleaning and sandblast operations before it is received by the welding department. Servel has developed many special hairpin, pushing, rotary and circular bending techniques, all largely done without inside arbors.

The welding rod used falls within the American Welding Society's specifications as regard analysis. Two sizes are used: 1/16 and 3/32 in. "Analysis alone is not sufficient to define the suitable rod," Mr. Kaufman informed me. "Freedom from all inclusions, gas

Fig. 5—The mating halves of absorber shells are quickly joined by submerged-arc automatic welding

bubbles and scale is vital to get leak-proof welds. The percentage of leaks found on our tests goes up immediately if a shipment of inferior rod is used. So critical is this that we have established unusually precise rod-receiving control."

Acetylene Generator House

In line with its progressive program for reconversion, Servel has installed a completely new windowless brick building to house acetylene generators. This contains a generator room approximately 34 by 28 ft floor space with 14½-ft ceiling and a storage room approximately 30 by 28 ft with an 11½-ft ceiling. The storage room has a capacity of 192,500 lb of carbide, the equivalent of five freight-car loads. This carbide is received in sealed containers and is unloaded from a freight car alongside the building.

This brick structure has many safety features incorporated in its design. The construction of the building complies with the most stringent fire insurance codes, and the roof is made to blow off in the event of an explosion. All of the electrical wiring is explosion-proof. The floor of the storage room is 2 ft 9 in. higher than that of the generator room to forestall the hazard of water coming in contact with the carbide while it is in storage. Either wood or non-sparking material is used throughout the building. The carbide cans are handled with non-sparking hoists to avoid any possibility of an explosion. Any dust which might collect in the storage room is removed by periodic vacuum cleaning of the floor. The building is ventilated with gravity-type roof ventilators.

The generator room was built large enough to house six stationary medium-pressure acetylene generators, but at present only four of these are installed. Each has a carbide capacity of 500 lb per charge, a water capacity of 500 gallons and will generate 1,000 cu ft of acetylene gas per hour at a maximum generator pressure of 15 psi. Line pressure is maintained at 12 psi, and positive safety devices make sure that the maximum pressure of 15 psi is never exceeded.

The four generators are cycled so that three will be in use while one is being charged. Each generator forms 113 cu ft of sludge per hour, which is drained into an outside sump. Automatic pumps force the sludge and water into three overhead tanks, each of 200 cu ft capacity. The sludge is allowed to settle and is then drained into "dumpster" trucks, which haul it away from the plant for disposal.

Prewar acetylene was supplied by two low-pressure, non-automatic acetylene generators, the gas being stored in a large storage tank of 2,000 cu ft capacity. In order to handle Servel's expanding production program, it was found advisable to go to the medium-pressure acetylene set-up. The gas is supplied through over 1½ miles of piping to the furthermost confines of Servel's 71-acre plant. The former acetylene pressure was approximately 9 oz gauge pressure, but under the new set-up the pressure is 12 psi.

Oxygen in Tank Trucks

To keep pace with the large-scale production of acetylene, liquid oxygen is delivered by special tank truck from Indianapolis, these trucks being in effect very large thermos bottles. There is some slight transit loss because the trucks are self-evaporating in order to keep the main liquid oxygen load sufficiently cold. "Upon receipt," Mr. Campbell explained to me, "the oxygen is transferred to a receiving tank and is evaporated from liquid to gas in auxiliary tanks. It is then piped to the welding stations. Oxygen pressure is held at approximately 28 psi as compared to a line pressure of 12 psi for acetylene."

A portion of the extensive system of oxygen and acetylene pipe lines is shown in Fig. 4. At present there are

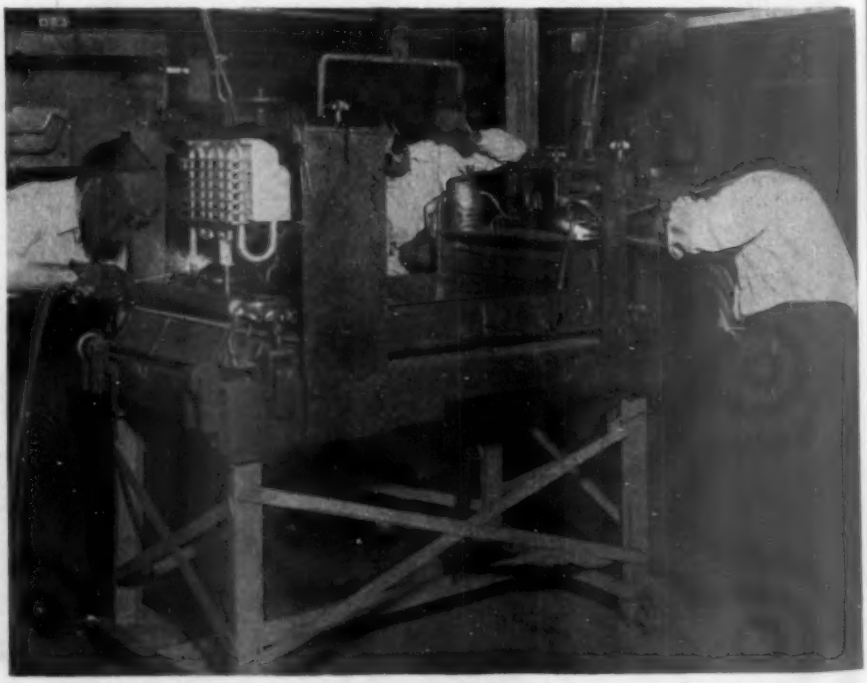


Fig. 6—Parts being assembled. This fixture will later be hung on an overhead conveyor line (see Fig. 7)

in use at the Servel welding department approximately 6,100 ft of acetylene and 6,100 ft of oxygen pipe lines. Plans call for the addition of 2,100 ft to both lines.

Training Gas Weldors

On V-J day Mr. Kaufman opened a 100-station welding school, operating two shifts a day. About 85% of the trainees were new employees who had not previously had welding experience. Afterwards many returned veterans were trained. "We make careful selection of our weldors with regard to eyesight and physical qualifications," Mr. Kaufman told me. "The training period is four weeks, during which each man receives a complete and general training in all types of welding.

"In training weldors, bridging and penetration are emphasized. Weldors are first taught on scrap plate material. They are then put on simple subassembly welds and are given more complicated welds as they become more adept. Some of the better weldors are used for repairing leaks found in welds previously made.

"During his apprentice period, each operator is usually assigned to a particular weld. It is easy to keep a complete record of his work. This is done by the record of the leak testers on particular welds, by numerical identification."

There are now a total of 302 weldors employed on the three subassembly and final assembly conveyor welding lines. There are also 100 assemblers and leak testers in the welding department. All types of vertical, horizontal, flat and overhead welding are used in the Servel conveyorized technique. A maximum amount of up welding is employed to gain better penetration.

Submerged-Arc Welding

As shown by Fig. 5, Servel uses submerged-arc electric welding to join the halves of the absorber shell. A special fixture was tooled to locate and clamp two mating parts. The work is then revolved to meet the welding arc while a granular flux is being fed through a spout. The weld is thus submerged in an atmosphere that excludes oxygen and slows the cooling rate. Use of the same process has been proposed for the welding of the pressure chamber assembly.

To return now to gas welding, there are 1,502 feet of overhead welding conveyor in the Servel welding department and 150 hydraulic welding seals which serve two torches each. For maximum production, the conveyor travels at the rate of about 7½ ft per minute or 468 ft per hour. The varied components of the three chief unit assemblies (to be subsequently defined) are clamped into swivel hangers (see Fig. 6), which are spaced 6 ft apart and suspended from the conveyor line as shown in Fig. 7. Operators with oxy-acetylene torches are stationed at regular intervals along the line and move with the conveyor as they apply weld metal to the joints assigned to them.

Subassembly Production Lines

The unit subassemblies are laid out in three lines and tacked together on subassembly benches located at right angles to the conveyor line. "The three subassembly lines," Mr. Deig explained, "are: (1) the condenser and absorber conveyorized subassembly welding line, (2) the evaporator and gas heat exchanger conveyorized welding assembly line and (3) the generator assembly line. The latter is a bench-welding operation, facilitated by belt conveyor travel rather than overhead conveyor. These various subassembly lines mate into the final welding conveyor assembly line, which then proceeds to the testing bays."

The condenser weld involves 25 parts in its tube and fin assembly and represents 22 finished welds with 22 tack welds. Steps in the progression of the complex condenser and absorber assembly are shown by Figs. 8 and 9.

Evaporator and Generator

The evaporator and gas heat exchanger assembly involves 21 pieces, 28 finished welds and two tack welds. The generator assembly involves 17 parts, 30 finished welds and 12 tack welds. The above number of parts excludes those not welded such as fins, disc, cups and plates. The variation of tack welds in Servel's five models is from 28 to 43; of finished welds, 53 to 69. Weights of units vary from 78 to 129 lb.

"One unit every 46 seconds or 78 units per hour can be turned out," Mr. Campbell particularized. "The time needed to execute a weld varies according to its length, position and other factors.

"Benefits from conveyorized welding have been major. We have found oxy-acetylene welding excellently adapted to the conveyor system. Lost motion in stacking and handling sub-

Fig. 7—Welding on one of the conveyorized assembly lines. Weldors keep pace with their moving work

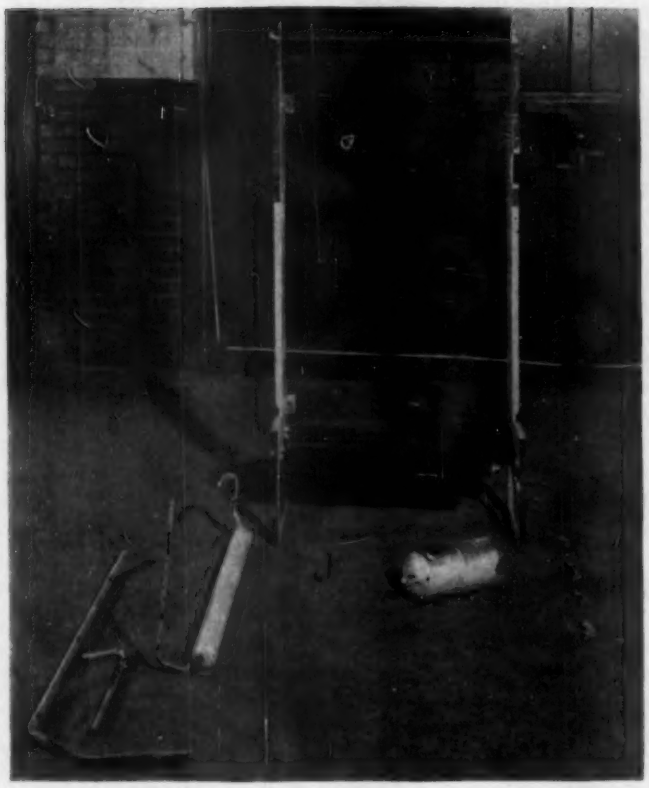


Fig. 8—Condenser and absorber as joined to the side rails. The pressure chamber, absorber pot assembly and tube connections will also be added to this subassembly

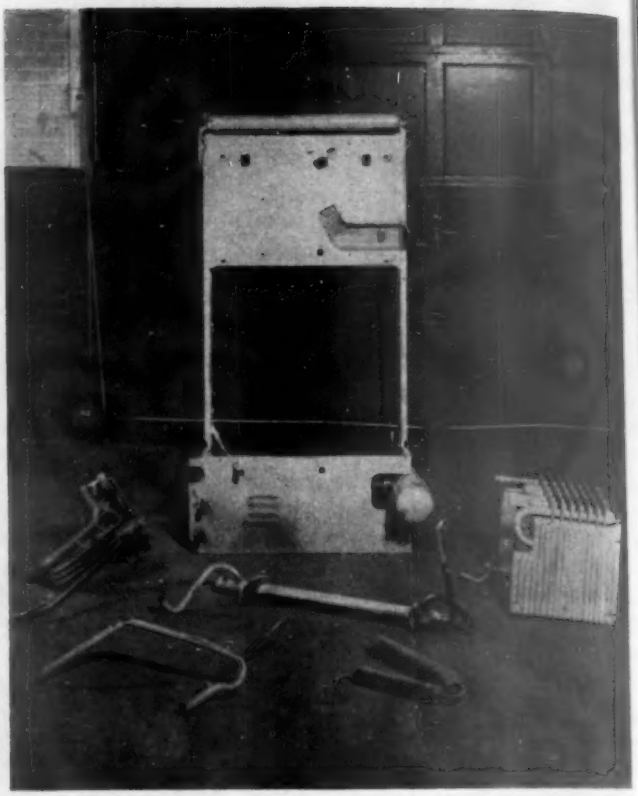


Fig. 9—Condenser and absorber subassembly completed by pressed-steel plates. Also shown are the generator, gas heat exchanger with connecting tubing and evaporator

assemblies has been entirely eliminated. The decline in the percentage of leaks—even though welding is accomplished while the work is moving—has been quite astonishing. Conveyor movement is not detrimental to quality of work; in fact, the quality and characteristics of finished welds have improved, along with the efficiency of operators. Of course the conveyor movement must be very regular and smooth."

Fixtures for Tacking

Tacking tables are located along the conveyor line, starting at a point where the welding has been completed on the gas heat exchanger. Heavy fixtures are used to hold the parts of the evaporator and gas heat exchanger assembly in proper alignment while they are being assembled.

One technique used by Servel in the production of these fixtures seems unusual. A sample of a particular unit will be carefully made up and used as a model to build the fixture. A steel plate about $\frac{5}{8}$ in. thick and reinforced by channel iron to prevent warping is used for the base of the various locating V-blocks and saddles. The blocks and saddles are made from channel iron sawed to the desired length and shape; they are placed in position and welded to the base plate.

"The varied subassemblies such as the evaporator and absorber assemblies are placed on the conveyor," Mr. Deig explained, "and ride to a point where the first major subassembly tacking fixtures are located. Here each is removed for tacking, and a tack-welded subassembly is put in its place on the empty swivel hanger of the conveyor line. The swivel hanger moves ahead to finish welding, which is divided among various operators.

"At the end of the finish welding, the line joins the other subassemblies. The generator subassembly has moved through its bench-welding sequence by belt conveyor to this point, at which the evaporator and gas heat exchanger assembly and the condenser and absorber subassembly also converge.

"The subassembly lines run parallel to the conveyor and ride to the point where it makes a U-loop around the final assembly fixtures. The subassemblies are taken off for tacking and placed back on the conveyor for final welding."

Testing for Leaks

After a cooling shower, the unit is submitted to a safety pressure test in a sealed and fortified booth. This rupture test is at 1,000 psi, far above normal operating pressures. "The unit is then tested six times under 800 psi pressure by applying a soap solution to all joints," Mr. Kaufman added. "If a weld is defective, bubbles will form at the point of the leak. Leaks are then repaired and retested. Finally, the completed unit is put through a straightening fixture to correct any warpage that might be caused by welding."

After having passed inspection, the unit is painted, tested again and charged with ammonia, water and hydrogen gas. It then goes to a test rack, where it is given a calorimetric run-in test to measure the accuracy of its refrigerating capacity. Back on the conveyor, it moves toward final assembly lines (Fig. 1) where, mated with the cabinet, it is packaged and made ready for shipment.

BY WALTER J. BROOKING
Director of Testing and Research,
R. G. LeTourneau, Inc., Peoria, Ill.

WELDING BULLDOZERS on an Assembly Line

Fig. 11—Both the right and left pushbeam structures were made at the same time in the combination set-up and positioning fixture shown above

★ Part Two—A bulldozer was once considered to be a tailor-made piece of equipment, but no longer. They are now turned out on a mass-production basis, with every welding detail standardized.

A common peacetime construction tool, the bulldozer was found to be a highly efficient instrument of war. In order to accommodate the large orders placed for them, R. G. LeTourneau, Inc., had to develop, lay out, tool up and organize a special plant for production assembly of two different sizes. Last month Mr. Brooking discussed the general plan of operation of the welding assembly line and gave details of handling methods, forming and flame-cutting components, stock control, set-up and positioning fixtures. The present and concluding installment gives additional welding details and also describes special machines that were built for machining, flame-cutting and flame-hardening operations.—THE EDITORS.

THE main pushbeam structures—one for each side of the unit—were made in pairs in the "spinner" fixture shown in Fig. 11. This produced a right and a left member at the same time, took less floor space and made the balancing of the fixture easier than with the single members. Clamps, tapered wedges, pins and stops facilitated set-up and removal and provided protection for premachined surfaces.

The main body structure was set up and welded in another spinner fixture. Fig. 12 shows the means by which the premachined substructures and parts of the main body of the bulldozer bowl were positively located and firmly held during welding.

Most of these fixtures were made so that one operator could do all of the welding on the structure. A team of two weldors was sometimes used on such units as the body structure, which involved several hours of welding.

The work was so organized that the man who welded the structure also took the parts from the rack, placed them in the fixtures, tacked them together and completed the set-up work. He, therefore, was responsible for providing as good a fit-up as possible in order to assure himself of the least loss of time in welding.

MACHINING SUBSTRUCTURES

Many of the parts which went into the original substructures required such simple machining operations as drilling, boring or punching holes, milling surfaces or turning and facing parts. Almost all of this machining was completed at the main plant as a part of the original cutting, discussed in the first installment of this article. Sometimes, however, parts required additional machining after they had been set up into substructures and welded together. This machining was done on standard machines when they were available and fitted to the characteristics of the job. Other work was completed in special machines.

The heavy-duty semiautomatic lathe shown in Fig. 13 is one of a series of arc-welded, semiautomatic lathes especially designed for the heavy-duty machining of forgings or welded structures. The picture shows it performing the combined drilling and boring operation required on one of the actuating devices for tilting the bulldozer body.

Fig. 12—The main bulldozer body was set up and welded in a spinner fixture. Most welds could be deposited in the downhand position or as horizontal fillets. A team of two weldors was sometimes used to speed the work

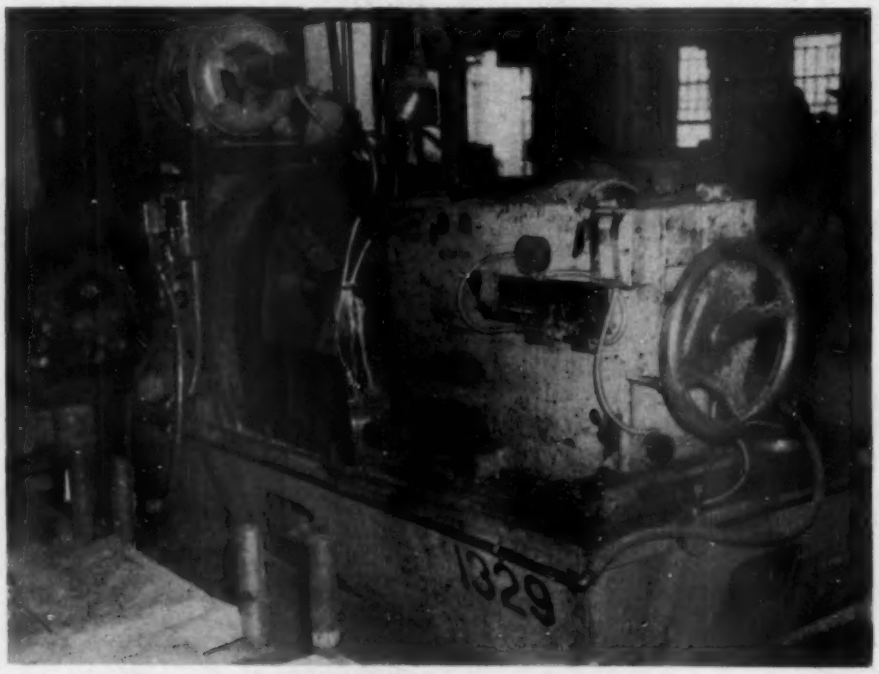


Fig. 13—This heavy-duty, all-welded, semiautomatic lathe was built to pre-machine bulldozer parts and to machine the welded substructures

The greatly increased number of bulldozers being produced required that certain items be made in much larger quantities than ever before. One example was the pin for the sheave wheels over which the cables operated.

A separate sheave pin machining and heat-treating line was set up in the bulldozer plant. The two bottleneck operations in making sheave pins were:

(1) The drilling of the many oil holes and tapping them for grease fittings, and (2) the heat treatment of the sheave pins prior to the final grinding.

A multiple-station automatic drilling machine of arc-welded construction (Fig. 14) was designed and produced to do the drilling and tapping job. This indexing machine eliminated much of the handling and effectively increased the production of pins with a marked reduction in labor, machinery and floor space.

The heat-treating problem was solved with equal effectiveness by the production of a special flame-hardening unit employing a pressure quench (Fig. 15). This unit is also of all-welded construction. It was designed and built within the plant to use city fuel gas with the positive pressure quench fixtures, the latter being shown in the right foreground of the picture. It provided a considerable increase in capacity for the heat treatment of the pins, required less floor space and reduced heat-treating costs.

Automatic Flame-Cutting

The production of the cutter blade for the bulldozer and the large number of spare blades which were ordered with them presented another mass-production problem. This was solved in part by an automatic flame-cutting machine designed and fabricated by welding. The multiple-torch unit (Fig. 16) cut four blade tips simultaneously (two sections with square cuts and two with angle cuts), leaving one square end and one angle-cut end on each finished tip. The operator had only to start the cut at the back edge of the blade, and the machine automatically cut to the front of the blade and indexed back to its original starting position, free of the blade. The cut sections were then removed, and the bar pulled forward for another cut.

The problem of painting the greatly increased number of blades and tips was solved by building a blade dip-painting unit. The saving in paint brushes alone went a long way toward paying for this dipping machine in a few months.

Cleaning and Painting

The finished welded structures were delivered to the monorails discussed in the first part of this article and were thus transported from the welding department. They proceeded through the metal-grit-blasting cleaning process, stopped at the spatter drop ("berry") removal and acid wash cleaning stages, and were then painted with a prime coat of olive drab paint. Each of the component structures was cleaned, blasted, washed and prime-coated individually, both

to ensure complete coverage and because they lent themselves to more convenient handling separately.

Fig. 17 shows the structures passing through the sandblast booth. A roomfull of structures was placed on the rails inside the sandblast chamber, and the doors were closed for the blasting process. Special attention was paid to see that all of the slag and loose mill scale were blasted from the welds. The units were then pushed on the monorail to the cleaning and washing area between the sandblast booth door and the paint booth. The suspending bars for running the structures on the monorail were made of the proper length to allow all of the work in the blasting, washing, berry picking (spatter drop removal) and painting operations to be done at the level most convenient for the workmen.

Fixtures were also made for the transportation of several of the smaller structures. The foreground of Fig. 18 shows a rack for trunnion brackets which permits a group of small structures to be processed all together without the use of a large number of suspending hooks and individual pushing along the monorail.

The design of the paint booth shown in Fig. 18 consisted of a water wash spray booth on the left side enclosed by a ceiling and a side wall. Two swinging doors at the exit end formed a closed booth and provided for an air draft into the water wash booth.

As soon as the prime coat of olive drab paint had been applied, the units were pushed out of the paint booth

(*Continued on page 56*)

Fig. 14 (left)—Automatic-indexing, multistage machine designed to drill and tap sheave wheel pins. Of arc-welded construction, this machine reduced investment, floor space and number of operations required. Fig. 15 (right)—This welded continuous flame-hardening unit also increased the efficiency of sheave pin production. The individual pressure quenching units are shown in the right foreground. The unit was designed to use city gas for the flame-hardening operation

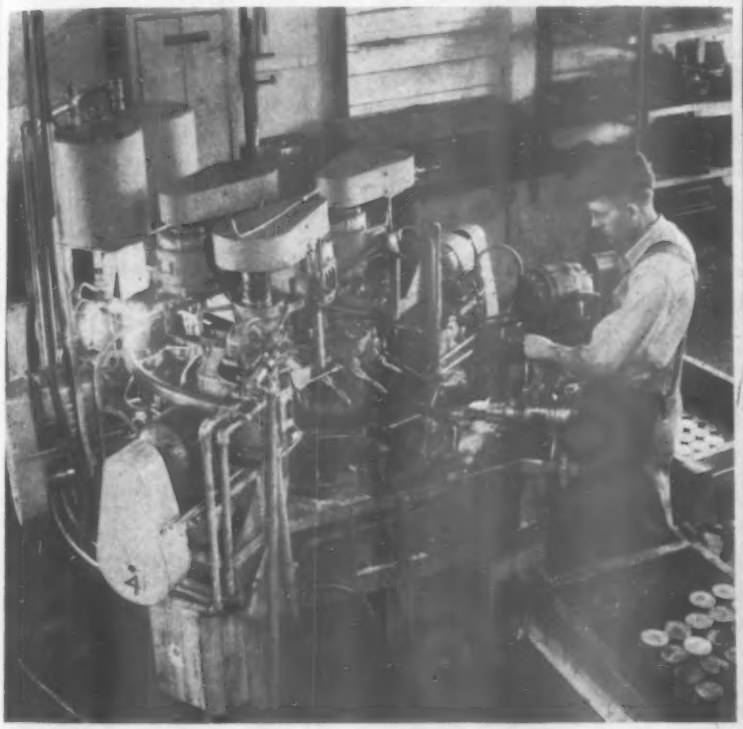


Fig. 16 (left, below)—Production of bulldozer blades was increased 200% by this semiautomatic flame-cutting unit. Fig. 17 (right, below)—Transportation to the sandblasting room was accomplished by pushing the units on the monorail

★ PRODUCTION

SEAM WELDING TURBOJET ELBOWS

BY FRANK G. HARKINS, *Resistance-Welding Engineer, Solar Aircraft Co., San Diego*

Application of seam welding to the inner elbow of the I-16 jet engine reduced fabrication time from 19.4 minutes to 75 seconds per part and entirely eliminated rejections due to warpage.

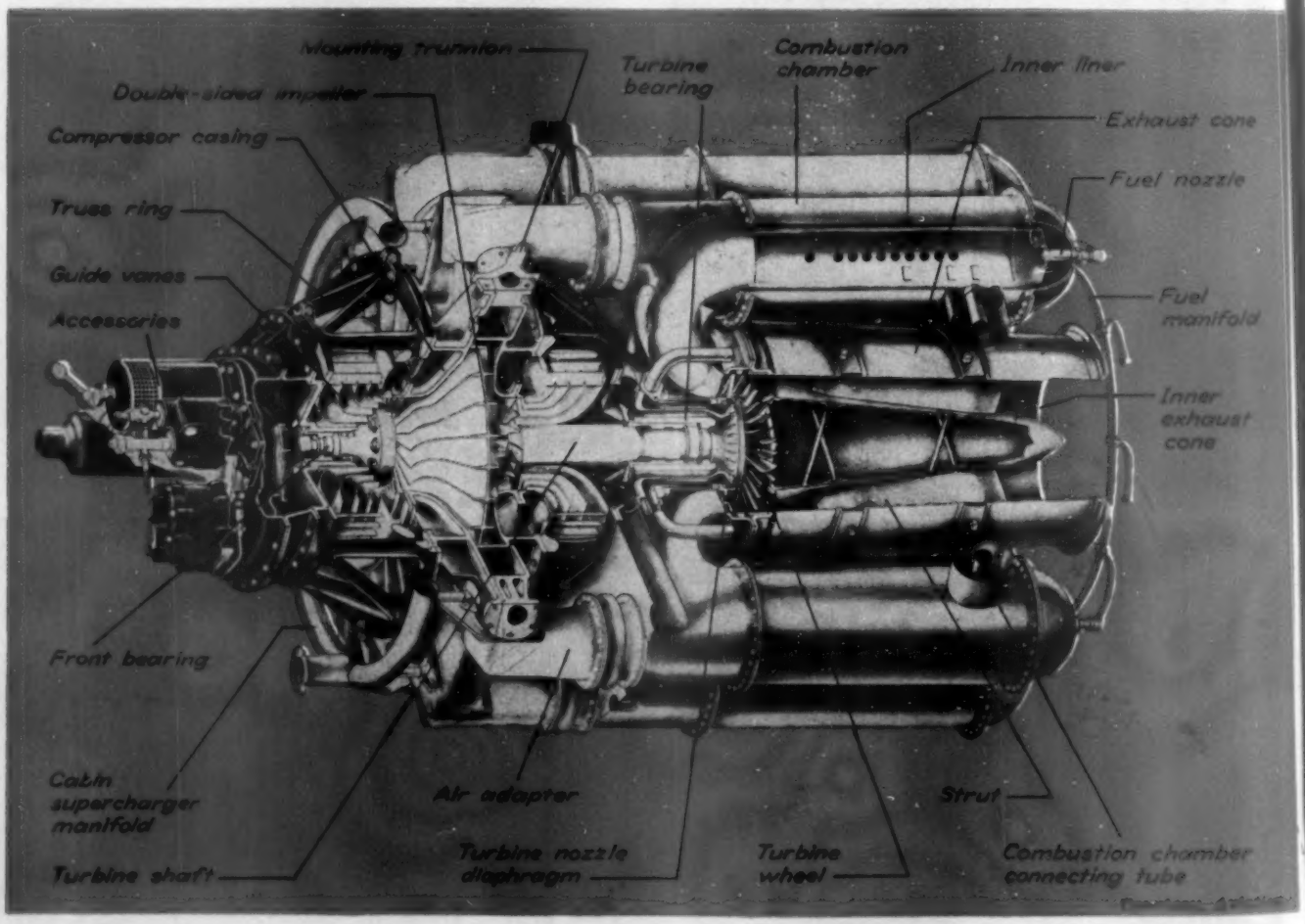
FABRICATORS of aircraft components found themselves during the war in the unenviable position of being required to produce vast quantities of precision parts through a willing but relatively unskilled working force. Because of the urgent requirements of the air forces, designers turned naturally to the resistance-welding processes. Here was the modern tool, the panacea which would break all the bottlenecks in industry! How well the challenge was met is familiar to all of us associated with the work. Many manufacturers learned that resistance welding can mean the achievement of otherwise impossible production schedules.

In the rush of wartime production many grave errors were made in the application of this superior tool. Ease and speed of production were the natural sequel to installation of spot, seam, or flash welder, but often small plant operators (and some large ones) were unaware of the essential qualifications and controls peculiar to these processes. Strict specifications were the Ordnance Department's safeguard against unwittingly faulty workmanship. Although the rigidity of these specifications seemed to add unnecessary burdens to the welding engineer, probably this code has done much to stabilize a phase of industry which had been hit-or-miss since its invention by Elihu Thomson in 1886.

JET ENGINE ARRIVES

Suitably controlled resistance welding had been accepted as a high-quality process for structural applications by the time the jet engine was developed. The first American jet-propulsion engine—now known as the turbojet—was built by General Electric at West Lynn, Mass., in the early part of 1942. Fig. 1 shows the chief compo-

Fig. 1—Cutaway view of the I-16 turbojet engine. The hot gases drive the turbine which operates the air compressor



nents of a G-E type I-16 jet engine. It is interesting to note the turbojet engine differs from the rocket in that the former carries an air compressor from which the compressed air is distributed into the combustion chambers. Approximately two-thirds of the available power of the engine is used in supplying the energy for turning the compressor. The rocket carries its oxygen in tanks or chemical compounds.

Because of the high strength required at high temperatures, special alloys had to be developed for jet engines, and these were, for the most part, extremely difficult materials to weld. The use of resistance-welding processes was still further restricted by the complicated shapes of the parts to be fabricated. By exercising imagination and ingenuity, however, the welding engineer could often produce a satisfactory part, and usually in about one-tenth the time that was required for other processes. While cost was a consideration secondary to the urgent need for production, the monetary savings were often impressive.

A typical turbojet engine part is illustrated in Fig. 2. This is the inner elbow of the I-16 jet engine. Its function is to conduct the gases from the combustion chambers through the nozzle diaphragm where they impinge upon the turbine wheel and supply the energy that turns the shaft of the air compressor. After passing through the turbine wheel, the gases enter the tailpipe, where the pressure drops. The pressure differential between the combustion chamber and the end of the tailpipe provides the thrust for the operation of the airplane, as is shown in the schematic diagram (Fig. 3).

There are ten elbows used on this engine, and they are made of Type 347 stainless steel 0.025 in. thick. The original design called for atomic-hydrogen hand welding. The complete atomic-hydrogen operation, including positioning, tacking and welding, required 19.4 minutes per part plus additional processing to remove oxidation and scale. Rejections due to warpage were high (about 18%). It was decided to try seam welding.

Seam welding was made possible by using two gooseneck lower horns (one inside and one out) made from bronze castings at a cost of $210. A $\frac{3}{8}$-in. lap is provided between the half stampings that make up the complete elbow. The parts are positioned and spot tacked in a fixture and then taken out of the fixture for seam welding at 40 in. per minute. The total fabrication time is 75 seconds per part, and rejections due to warpage are entirely eliminated. The ratio between the two

Courtesy, Taylor-Winfield Corp.

Fig. 2—The roll-welded inner elbow conducts gases to the turbine wheel

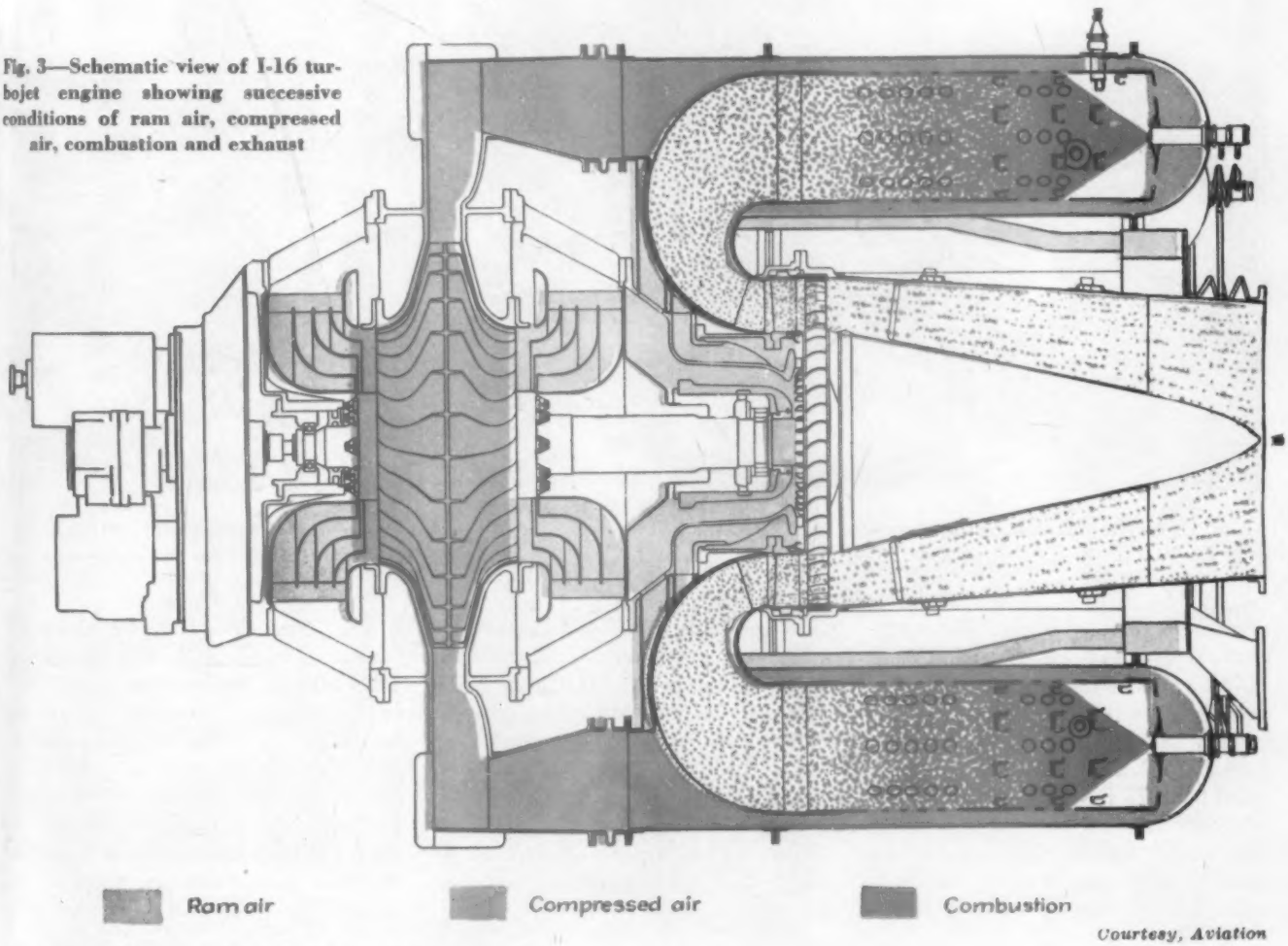


Fig. 3—Schematic view of I-16 turbojet engine showing successive conditions of ram air, compressed air, combustion and exhaust

Courtesy, Aviation

processes is thus 15 to 1 in favor of the resistance-welding technique.

Welding Inside Seam

Fig. 4 shows the machine as set up for welding the inside seam. To clear the current-carrying shunt of the top electrode, it was necessary to extend the upper electrode and the lower horn about six inches to the left of the centerline of the machine. The radius of the inside seam of the part is so small that the diameter of the top electrode can be only 2 in. The length of the stroke of the air cylinder on this machine is 4 in., so it was necessary to raise the lower horn to bring the electrodes together. How this was done appears in Fig. 4.

Another problem was introduced by the use of the small-diameter upper electrode. On this machine the top guide the work through the machine.

Fig. 5 shows the welding of this inside seam. Because of the large diameter on one end of the elbow, it is possible to make a continuous weld over the length of the seam instead of working from the center to each end.

Welding Outer Seam

Fig. 6 illustrates the machine set-up for welding the outer seam, a fairly straightforward application employing the standard 8-in. diameter wheel top electrode.

The actual welding operation on the outer seam is shown in Fig. 7. It is not possible to make a continuous seam in one operation. The seam is started in the center and carried to the outer edge, then the part is turned around, slipped over the horn and welded out to the other edge. The following ma-

Courtesy, Taylor-Winfield Corp.

Fig. 5—Welding the inner seam of the elbow. Note the small-diameter electrode wheel (2 in.)

Courtesy, Taylor-Winfield Corp.

Fig. 4—Machine set-up for seam welding of the inside seam

Fig. 6—An electrode wheel of standard 8-in. diam is used for the outer seam

wheel is the driving wheel. The equipment is designed for operation with an 8-in. diameter top wheel and a welding speed range of 25 to 75 in. per minute. Reducing the drive wheel from 8 to 2 in. reduced the welding speed from 75 in. per minute to about 18 in. per minute. Changing the pulley ratio on the Reeves drive increased the speed to 40 in. per minute, which is about as fast as the operator is able to

chine constants have been established:

Machine: 200 kva; time cycle; 3 on, 2 off; pressure: 800 lb; welding speed: 40 in. per minute; electrodes: material—Class III; diameter—top: 8 in. (for outside seam); 2 in. (for inside seam); bottom: 2 in.; width: ½ in. with 3 in. radius of dome; heat setting: 45% corresponding to approximately 8,900 amp; transformer: low tap.

The outer elbow adapter assembly, illustrated in Fig. 8, is also an unusual fabrication. The function of this part is to conduct air from the compressor into the combustion chamber and to support the inner elbow assembly. The elbow part of this assembly is made of Type 347 stainless steel 0.063 in. thick. The adapter section is Type 347 stainless steel 0.025 in. thick. Formerly, the eyeletted seam on this

assembly was made by the atomic-hydrogen process, requiring 40 minutes per part with the usual difficulties of poor fit, rigid tolerance, and high rejections due to warpage. The sequence of operations with atomic hydrogen is: position back and front section in welding fixture, tack and weld adapter section, position 0.063-in. elbow through adapter in fixture, peen flange to fit elbow, spot tack, atomic weld.

It seemed practically impossible to attempt to roll weld the eyeletted seam because the back of the adapter interfered with the lower horn of the welding machine. However, study of the assembly revealed that if the elbow were assembled to the eyeletted half stamping the seam-welded assembly could be made on a standard machine, with standard tooling, before assembling the adapter. Thus the operational sequence was: position elbow and front of adapter in fixture, spot tack with portable gun, roll weld, position back and front of adapter in fixture, spot tack and weld. The time saving was 38¾ minutes per part.

This example illustrates a frequent experience of the welding engineer: that where it may not be possible to substitute machine welding for hand welding in a given operation sequence, the entire sequence may be revised to permit the more efficient method.

There are many other instances of resistance-welding applications to other components of this newest type of aircraft engine. Among them are a change on the turbine wheel housing resulting in a saving of almost $100 per part. On the tailpipe, nearly 1,500 in. of resistance welding is performed in less than an hour.

Meets Rigid Tolerances

Fig. 9 illustrates assembly of the adapters and elbows to the turbine wheel housing. Specifications are rigid: there must be no leakage at 45 psi hydraulic pressure under individual and collective test. An example of the dimensional tolerances is the illustrated turbine housing, which is 19.752 in. ± 0.002 in. It is doubtful if any other process than resistance welding could be used because of the heat shrinkage and warpage which accompany, to a much greater extent, the use of gas or arc welding.

Courtesy, Taylor Winfield Corp.

Fig. 7—Close-up of welding operation on outer seam

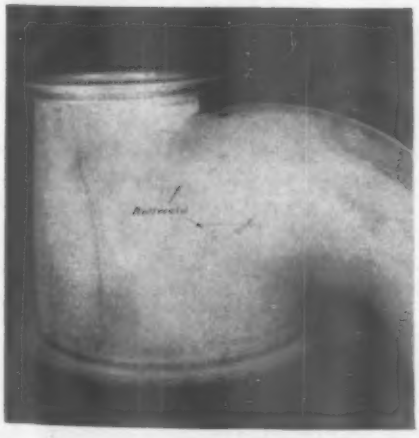


Fig. 8—Roll-welded outer elbow adapter assembly

Fig. 9—Ring and elbow assembly. Each of these ten seam-welded elbows is compelled to meet a 0.002-in. tolerance

WELDING BULLDOZERS

(*Continued from page* 51)

and allowed to dry until they could be handled without damage to the paint covering.

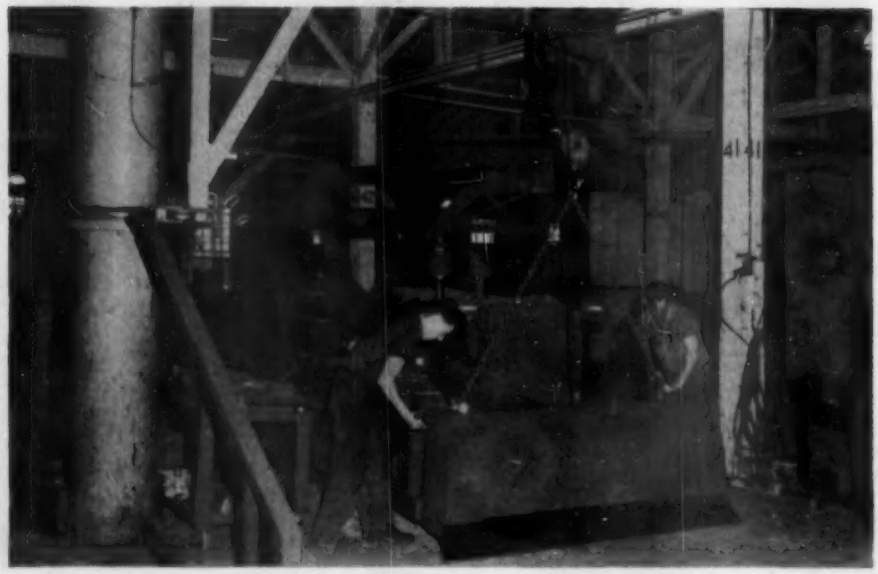
Assembly Operations

When the paint was dry, the structures outside of the paint booth were switched onto one of the exit tracks of the monorail and were either taken to one of the several assembly stations or were shifted out of doors for temporary storage pending the arrival of the tractors upon which they were to be mounted.

Normally, the component structures of an assembly were taken from the monorail and stored in small racks adjacent to an assembly station such as shown in Fig. 19. A tractor was driven in, and the power control unit (brought from the main factory) was mounted. The assembly process was carried out under a jib crane by a crew of two men, who worked according to an established schedule of operations.

Fig. 18—After blasting, washing and spatter-drop removal, these small structures were moved as groups to the paint booth to receive prime coats

Fig. 19—Most units were assembled immediately after painting at one of the five stations. Power testing and final painting followed immediately



The moving parts, bolts, nuts, screws, small parts and small accessories were delivered from the parts room prior to the beginning of the assembly process.

Several such assembly stations were available in the layout, and each assembly crew had its own little assembly pushcart (Fig. 19, by the jib crane post) on which were kept tools, some small parts, fittings and work orders. All of the moving parts and adjustments were tried out under power of the tractor to ensure the proper assembly and adjustment of the unit at the assembly station.

Final Painting and Shipment

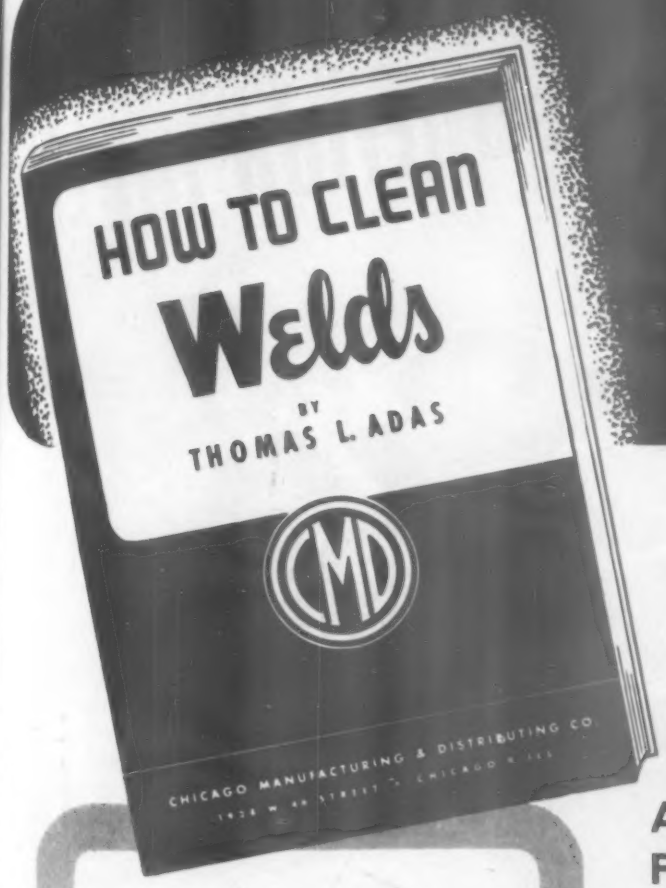
The tractor with its bulldozer supporting structures and power control unit was driven from the assembly station to the area immediately before a second paint booth. Here the grease, dust and other foreign materials which had accumulated during the assembly process were washed away in preparation for the final painting process. The unit was then driven in under its own power, to the final paint booth, where the olive drab green cover coat was applied by spraying. While the unit was still in the booth, identification data together with certain weights, numbers, etc., were stencilled upon it. The bulldozer was then driven under its own power out of the plant and to the temporary storage dock, where the paint was allowed to dry thoroughly.

Final processing operations included the spraying of all of the moving parts with rust-inhibiting material, the processing of the cables, tilt control mechanism and power control unit moving parts, and the final rust prevention and machine conditioning given to the tractor and power control unit.

Car loading was done on the same track, adjacent to the bulldozer plant, that the incoming carloads of tractors arrived on. Loading and unloading was done by means of a ramp which reached a height level with the flatcar bottom. The bulldozers were then carried to their final destination at some military depot or port of embarkation.

Cleveland-Tungsten Buys General Tungsten Co.

Cleveland-Tungsten, Inc., Cleveland, a subsidiary of the Molybdenum Corp., of America, has purchased General Tungsten Manufacturing Co., Inc., Union City, N. J.



This NEW FREE Booklet

WILL HELP YOU

- Improve Workmanship
- Increase Production
- Reduce Costs

AUTHENTIC INFORMATION FOR EXPERIENCED WELDORS AS WELL AS BEGINNERS

"How to Clean Welds" will help you teach apprentices the *right methods first,* and give experienced weldors welcome suggestions on short-cuts that save their time. It will help you prevent mistakes that waste metal and require rewelding and consequent delays. Send for a copy today!

16 DATA-PACKED PAGES *On All Phases of Weld Cleaning*

1. **Importance of Weld Cleaning.** Harmful effects of dirty welds.
2. **Methods of Cleaning Welds.** Hammer and brush grinding, chemicals.
3. **How to Clean Arc and Gas Welds.** Ferrous, Non-ferrous, bronze, light metals.
4. **Tests of a Clean Weld.** Visual, chemical.
5. **Cleaning Before, During, and After Welding.** New and old techniques.
6. **Effect of Rust, Oil, and Dirt on Welds.** Importance of pre-weld cleaning.
7. **Cleaning Subsequent Beads, Fillets, Grooves.** The right way to handle these operations to thoroughly remove slag.

Mail Coupon NOW!

Chicago Manufacturing & Distributing Co.
1928 West 46th Street, Chicago 9, Illinois

Please send (.....) copies of "How to Clean Welds."

Name .....

Address ..... State .....

City .....

Clean Welds Mean Sound Welds – Lasting Satisfaction

FIND THE ANSWERS TO YOUR METAL PROBLEMS AT THE METAL SHOW

ATLANTIC CITY MUNICIPAL AUDITORIUM—NOV. 18-22

— Chances are, you will quickly spot the answer to your production problem of the moment at that great Fall gathering of metal men and metal ideas — the 28th National Metal Congress and Exposition, Atlantic City Municipal Auditorium, November 18 to 22.

For at this big annual event, the missing ideas quickly fall into place. More than 300 manufacturers of metals, machinery, and processes will display their latest and most timely production ideas for your convenient inspection. Practically all exhibit spaces in the vast Auditorium and Exhibit Hall have been reserved. Industry will concentrate its latest developments for you in Atlantic City.

And if you don't see your idea in operation in the Exposition, you may hear it explained in one or more of the technical sessions presented by the four great national societies listed below. Never have so many papers and lectures been scheduled during a single Metal Congress. More than a hundred papers will be presented, dealing with metals, heat treatment, welding, cutting and various processing and fabricating techniques developed during the war years.

So plan to attend this Atlantic City Metal Show — mark your calendar now for November 18 - 22, Monday thru Friday. If you haven't made hotel reservations, do it today — write Housing Bureau, National Metal Exposition, 16 Central Pier, Atlantic City.

ATTENTION MANUFACTURERS —

A few good exhibit locations are still available. If you have a product to introduce — a metal industry market to cultivate, wire or phone for space details to W. H. Eisenman, 7301 Euclid Avenue, Cleveland — Phone Endicott 1910.

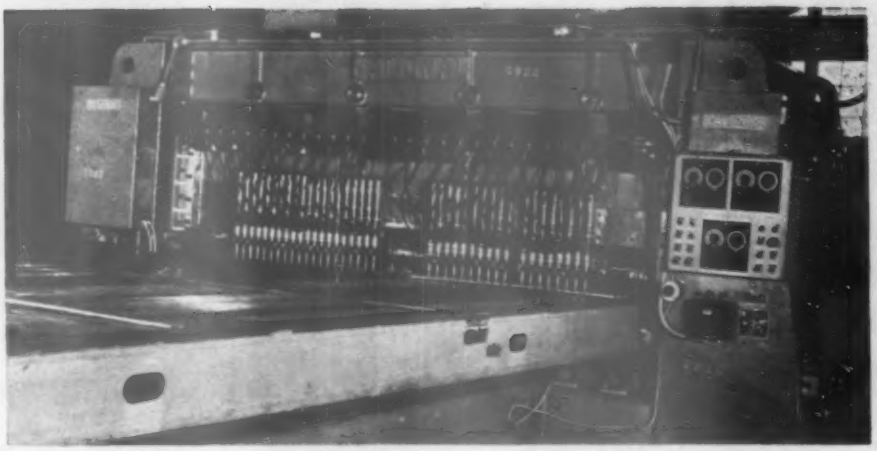
NATIONAL METAL CONGRESS AND EXPOSITION

Sponsored by the American Society for Metals in cooperation with

The American Welding Society . . . The Iron and Steel and Institute of Metals Divisions of the American Institute of Mining and Metallurgical Engineers . . . American Industrial Radium and X-Ray Society.

48 Welds Made at One Stroke

A HUGE new multiple spot welder, one of the largest of its type in existence today, has been built by National Electric Welding Machines Co., Bay City, Mich., to weld stiffeners to



Any number of welds, up to 48, may be made at a single stroke on this multiple spot welder installed at Pullman-Standard's Chicago plant

the interiors of car sides at the Chicago car works plant of the Pullman-Standard Car Mfg. Co. A stiffener is a sheet of light-gauge corrugated metal which is welded inside the walls of the car to lend strength and smoothness, much on the same principle as the corrugation on the interior of a cardboard box. The principle of applying multiple spot welding to this work was developed during the war period.

Use of the new spot welder will increase production in the department about 300% over present processes, say Pullman-Standard engineers. In operation, a metal bed or table 30 ft long by 10 ft wide travels beneath a battery of 48 stationary welding electrodes. The work is laid flat on the top of the table, which has been covered with a copper plate to serve as the lower electrode. The bed moves slowly beneath the row of upper electrodes, stopping at predetermined intervals. Whenever the table stops, the row of electrodes lowers to weld the stiffener to the car side. The electrodes then lift up, and the table moves on to the next welding position.

A unique electric-eye arrangement renders the entire operation automatic. Two rows of small holes are drilled about ¼ in. apart along one side of the bed, and a beam of light is directed through these holes from beneath. If the beam is allowed to strike a photoelectric cell above the holes, the circuit is completed. Relays then operate to stop the table, lower the electrodes, make the weld, lift the electrodes and start the table moving again. The table continues its travel until another open hole passes over the light ray to begin the cycle anew.

The various welding positions are preset by dropping loose rivets to block the holes that are not needed in the particular operation.

WIRED FOR SPEED

MORE WELDS PER MAN-HOUR
MORE SAVINGS FOR YOU!

1 Thousands of twisted wires properly shaped provide extra-flexibility. Less tiring for worker to handle.

2 Tough construction offers greater resistance to abrasion, oil and water. Less time out for repair.

3 Bright copper wires of hair width sizes provide high conductivity. Steadier power on the job.

4 Heavy live rubber jacket and heavy tape wrapping protect wires. Prevent "shorts" and breakdowns.

BURDOX
EXTRA-FLEX welding cable

"4 FEATURE" Extra-Flex Cable gives you more welds . . . better welds per man-hour because it works with the man-on-the-job. With its many exclusive production advantages, it costs you far less than you would expect to pay for cable of this high quality. Next time you order cable specify "Extra-Flex"! Immediately available in sizes from 6 to 4/0 from your welding supply distributor. If he cannot supply you, write direct.

Send for new free 64-page catalog of latest type welding and cutting equipment.

THE BURDETT OXYGEN CO.
3304 Lakeside Ave. • Cleveland 14, Ohio
Welding and Cutting Equipment and Supplies
Industrial Safety Equipment

The Burdett Oxygen Co.
3304 Lakeside Ave., Cleveland, O.
☐ Please send copy of free 64-page catalog.
Name .....
Company .....
Address .....
City & State .....

Fig. 6—Copper tubing on the ceiling of the second floor, south office building. Note how the distances between loops decrease toward outside wall

RADIANT HEATING

(Continued from page 43)

cated in the field by using manual oxy-acetylene welding to connect the shorter sections of 1¼-in. pipe. Arc welding is then called upon to join the long laterals with the 2-in. headers.

Less common is another type of grid (Fig. 2) using long 2-in. headers (140 ft) and short 1¼-in. laterals (20 ft). This was the type of construction originally planned, but difficulties encountered in the cutting of the 2-in. pipe necessitated substitution of the type of grid shown in Fig. 1.

The grid construction offers many advantages. It permits future changes in floor arrangements and foundations because new headers can be installed as needed around the new foundations. It makes possible the mass production of headers and laterals, whereas the coil-type construction necessitates a tailor-made cutting, fitting and bending job for each loop. Finally, grid construction permits the use of random lengths of pipe—a considerable economy.

Coils and Combinations

Nearly all of the remaining 20% of the wrought-iron piping on the ground floor consists of a combination of grid and continuous coil. This is well exemplified by Fig. 3. Headers were introduced into the continuous coil construction in order to: (1) reduce resistance to flow where it was too great for the capacity of the pumps and (2) guard against future changes in floor arrangement and foundations. The effect of using headers in a continuous coil panel is to break it up into two or three smaller coil circuits.

Necessity also played its part in the use of the combination systems since the company was able to procure pipe suitable for coil constructions when it could not obtain pipe for the grid laterals.

One single continuous coil without headers (Fig. 4) was designed and built for purely experimental reasons. The floor area concerned is near a large furnace in which the heat will exceed 1,600 F. By circulating unheated water throughout the 2-in. piping of this large coil, company engineers plan to measure the rate of heat transfer through the concrete slab.

Altogether, there are 40 miles of wrought-iron piping, and around 12,000 welded joints were needed to complete the installation. None of these welds have been buried and forgotten. Blueprints filed in the company's offices show the exact location of every weld, every bend, every header and every lateral in the entire plant. This engineering forethought will add much to the ease with which future studies can be made and future changes in plant layout effected.

Bundy Tubing Installations

All of the heating installation on the mezzanine floor (Fig. 5) is of Bundy tubing, a material formed of sheet steel clad on either side with a thin copper coating. This material is, in general, bent and joined like copper tubing, though it is somewhat easier to handle. It was chosen because it was the only tubing available that would fit into the reduced thickness of the concrete constituting the mezzanine flooring. All of the Bundy tubing used on the mezzanine is of 5/8-in. OD with a wall thickness of 0.049 in. The installation is a grid-type construction, with center-to-center distances spaced from 6 to 12 in., depending upon the estimated rate of heat loss.

Bundy tubing was also embedded in the ceiling of the entrance lobby of the south office building to provide an added concentration of heat at the glass exposure. Here a coil-type installation was made. Altogether, some 8,000 lineal feet of this material were employed, necessitating approximately 900 joints—all made by the oxy-acetylene method.

For the first floor office flooring, wrought-iron grid construction was used. In the ceiling of these first floor offices, an auxiliary wrought-iron surface was installed at the outside exposures to add radiating surface at the windows of the second floor and for the ceiling of the first floor.

Copper Ceiling Coils

The office area heating was completed by the installation of copper coils in the ceilings of second floor offices. The bulk of the 25,000 ft of copper tubing used in these ceiling installations is of ½-in. OD (nominal 3/8 in.). The tubing was formed in a wooden jig into a series of loops with center-to-center distances varying from 4 in. at the outside exposure, to 5 in., to 6 in., to 8 in. and finally to 10 in., the required concentration of radiant surface decreasing as the distance increases from the outer wall.

Between 12,000 and 13,000 joints had to be brazed in the formation of the copper ceiling coils. All of these joints were made by oxy-acetylene brazing, using an alloy (melting point 1,300 F) containing about 15% silver, 80% copper and 5% phosphorus. After brazing, the joints were annealed in order to draw the hardness.

The coil shown in Fig. 6 has just been installed on the "scratch" coat of plaster. With the copper loops wired in place on the ceiling, a ¼-in. "brown" coat and then about ½ in. of acoustical plaster will be laid to completely cover the coil, just as the wrought-iron grids and coils are buried in the concrete floor slabs.

Do you have this booklet on THERMIT WELDING?

Contains four-color illustrations of how the Thermit welding process works. Explains basic difference between Thermit welding and other methods. Shows how the process can be used to advantage... how large castings and fabricated parts can be joined quickly and economically. Explains the nature of Thermit steel. Contains over 50 illustrations.

HOW TO BUY THERMIT WELDING

Because of the nature of the Thermit process, and the fact that it is used primarily for heavy-duty welding, you can arrange to utilize its merits in any one of three ways...

1. Parts to be repaired or fabricated can be shipped to us for welding...
2. We can do the work with *our* crew in *your* plant...
3. Welding can be done by *your* crew in your plant under the supervision of a Metal and Thermit engineer.

If you are looking for a quick, dependable means of repairing or fabricating heavy parts, Thermit welding is your answer. Why not contact our nearest office today? Metal & Thermit Corp., 120 Broadway, New York 5, N.Y., Albany, Chicago, Pittsburgh, So. San Francisco, Toronto.

THERMIT WELDING

FREE Booklet on Thermit Welding gives details of the process and many application pictures. Fill in and mail coupon.

Metal & Thermit Corporation
120 Broadway
New York 5, N. Y.

Please send my copy of Thermit Welding Booklet.

Name_____

Position_____

Company_____

Address_____

_____

★ CONSTRUCTION

Building a 300-Ton Welded Trailer

BY C. W. LYTTON
Sales Engineer,
Lincoln Electric Co., Franklin, Pa.

Faced with the transportation of an important load of military supplies over a crude sandy road in a western desert, the U. S. Army ordered a 300-ton, 64-wheel trailer. It was built in 30 days—thanks to welded construction!

THE story of how welding was used to build a giant 64-wheel trailer carrying a load of 300 tons can now be told. Faced with the transportation of heavy equipment to be used in an important military project in a western desert, the United States Army ordered one trailer which would be capable of carrying a 300-ton load for a distance of 30 miles. The Rogers Brothers Corp., a pioneer trailer manufacturer of Albion, Pa., was selected to build the trailer.

The finished job is pictured in Fig. 1, and a close-up of the main frame in Fig. 2. The trailer measured more than 39 feet long by nearly 17 feet wide and weighed 75 tons. It was designed and built in 30 days. This record-breaking time resulted largely from the use of arc-welded construction, which, by the way, has been the standard practice in all trailer construction by Rogers Brothers in recent years.

The main frame was constructed from 14 by 14½ in. by 103-lb Mayari beams while the supplementary members were 12 by 12 in. by 72-lb Mayari beams. In preparation for welding, all joints were ground and beveled. The frame was then assembled, squared up and tack welded before final joining.

Equipped with 64 wheels (eight rows with eight wheels in a row), the trailer was built in sections so that it could be loaded on railroad flatcars for shipment to the scene of operation as it was too large to transport on street or highway. Steel beams 25 feet long were mounted on the trailer to support its important military load on the 30-mile trip. The journey, it is interesting to note, was made at a speed of only 3 miles per hour over a crude sandy road in the desert.

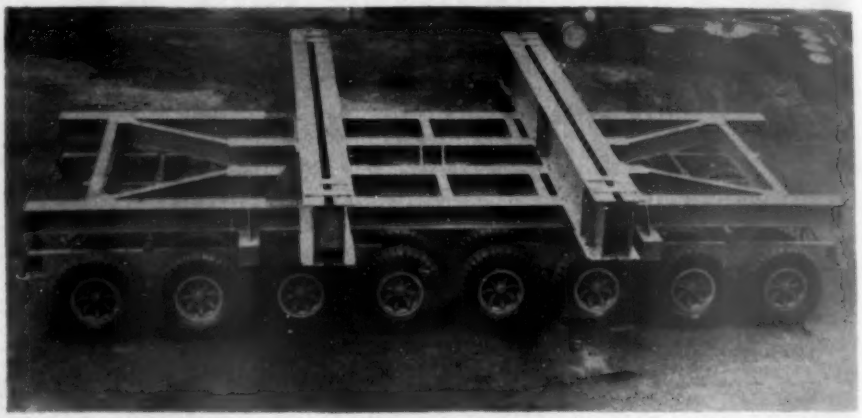


Fig. 1—The 64-wheel, 300-ton welded trailer built by Rogers Brothers Corp., Albion, Pa. Note the two 25-foot steel beams which supported the load

Fig. 2—A close-up of welded construction in the trailer's main frame

Punch press frame repair-welded with 52 lb. of ⅜" Tobin Bronze by the Sutton-Garten Company, Indianapolis, Ind.

Saved from the scrap pile... with TOBIN BRONZE

WHEN this punch press frame fractured, Tobin Bronze* *repair welding* saved months of delay...and the purchase of a new frame.

The Sutton-Garten Company of Indianapolis, using 52 lb. of ⅜" Tobin Bronze Welding Rod, did the job in two days... one for preparation, one for welding. The press was out of service only four days.

Low-temperature bronze repair welding has become the generally accepted method for reclaiming worn, fractured, or broken equipment. This method...applicable to cast iron, steel, malleable iron or copper alloys...is also widely used for building up worn surfaces.

For detailed information on Anaconda Welding Rods, including Tobin Bronze and "997" (Low Fuming), write for Publication B-13.

*Reg. U. S. Pat. Off.

ANACONDA

Anaconda
WELDING RODS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: ANACONDA AMERICAN BRASS LTD.,
New Toronto, Ont.

The Technical Slant

"I will study and read, and some day my time will come"—Abraham Lincoln

Manual on Aluminum Welding

WELDING ALUMINUM. *Published by Reynolds Metal Co., Louisville 1, Ky., 1946. Paper, spiral bound; 6x9 in., 88 pages. Price $1.*

This concise volume presents a comprehensive resumé of the latest practices and recommendations for the joining of aluminum by gas welding, arc welding, resistance welding, brazing and soldering.

The book begins by considering the weldability of the more widely used aluminum alloys, including also heat-treatable alloys and aluminum castings. The discussion is carried on into the gas welding of aluminum alloys and covers such topics as edge preparation, cleaning, preheating, type of flame, welding rods and fluxes, welding techniques.

The arc-welding section covers the processes of metal-arc welding, carbon-arc welding, atomic-hydrogen welding and inert-gas-shielded welding. Specific information is presented regarding filler metal, the manner of striking the arc, electrode angles, electrode motion, automatic welding, etc.

Resistance welding, the most widely used process, is broken down into several sections. Spot welding, for instance, is considered from the standpoints of conventional a-c, electromagnetic stored-energy, electrostatic stored-energy and storage-battery welding methods. Data are also presented on seam and flash welding, and much general information is given on preweld cleaning, tip pick-up, where to look for trouble, etc.

Furnace and torch brazing, soldering, weld inspection, metallurgy of welds are covered in later sections of the manual. Then comes an appendix, which includes seven large tables packed with such information as "Torch Welding Data for Aluminum of Various Thicknesses," "Welding Rod Sizes for Various Thicknesses of Sheet" and similar information for arc-welding electrodes and machine settings for resistance welding. The final two pages before the index explain the metallurgy of a typical spot weld, illustrating the various types of structures that will be encountered.

☆ ☆

Inspection Handbook

INSPECTION HANDBOOK FOR METAL-ARC WELDING. *Published by American Welding Society, New York City, 1945. Paper, 6x9 in., 156 pages. Price $1.50.*

This most complete and authoritative manual started as an emergency standard developed for use of the Ordnance Department during the war. Originally intended as a training test, it was distributed widely to government inspection agencies as well as to training centers. Even though the basic text was written with special reference to ordnance specifications, the material covered is equally applicable to other welding applications. For this reason, AWS decided to release the book for the benefit of the peacetime inspector.

As now published, the handbook contains sections on welding procedure and the qualification of weldors, but the major portion of the text is devoted to inspection methods and test procedures, including chemical and metallographic tests as well as mechanical tests for both base and weld metal. Other sections cover visual inspection, the use of appearance standards, magnetic-particle inspection and radiography. Each of these sections is well illustrated by means of sketches and photographs, as is also the portion devoted to weld defects and their possible causes.

A virtual "must" for welding inspectors, the Inspection Handbook will also be found to be of value by many who are less closely interested in welding inspection and its related problems.

☆ ☆

Welding of Castings

THE METALLURGY OF STEEL CASTINGS. *By C. W. Briggs. Published by McGraw-Hill Book Co., New York City, 1946. Cloth, 6x9 in., 633 pages. Price $6.50.*

Mr. Briggs, who is technical and research director of the Steel Founders' Society of America, has developed a single-volume reference of present-day methods of technical and industrial control in the production of steel castings. "The Metallurgy of Steel Castings" will be found to be an excellent reference book containing an up-to-the-minute account of the metallurgical problems, their solutions and recent research as applied to the steel casting field.

Much of the test material was first presented in lecture form before meetings of technical and operating men in the steel industry. The book, however, has not been prepared solely for technical men but has been written in a manner that will be readily understood by operating men, workers and apprentices in the steel casting industry as well as by those who buy or design castings.

The book describes in detail every process used in the manufacture of high-quality steel castings from basic open hearth, basic electric, acid open hearth, acid converter and acid electric steel. There are other chapters on heat treating, metallography, etc.

Of special interest to readers of THE WELDING ENGINEER is the 49-page chapter on the welding of castings. This discusses the various processes available to weld castings, the weldability of materials, preparations for welding, electrodes and filler rods, welding techniques, locating and repairing defects, heat treatment of welds and the metallurgical changes which result from welding. The chapter closes with a lengthy bibliography dealing with the welding of castings.

☆ ☆

Revised Building Code

STANDARD CODE FOR ARC AND GAS WELDING IN BUILDING CONSTRUCTION (D1.0-46). *Published by American Welding Society, New York City, 1946. Paper, 6x9 in., 68 pages. Price 50c.*

A 1946 edition of the "Standard Code for Arc and Gas Welding in Building Construction" has just been published to replace the 1941 (tentative) edition. This code in its earlier editions has been widely adopted by municipalities for the administration of welded constructions under their jurisdictions. The new edition embodies revisions that are based on experience in the recent applications of welding to structural fabrication as well as on further research investigation.

The section on design now provides for increased allowable weld unit stresses equal to those allowed for the steel being welded. Among the other sections revised are those on filler metal, workmanship, inspection, qualification of welding operators and procedures.

☆ ☆

Surface Tension Phenomena

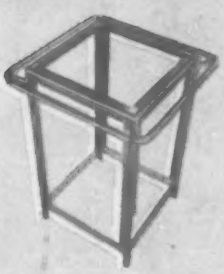
SURFACE ACTIVE AGENTS. *By C. B. F. Young and K. N. Coons. Published by Chemical Publishing Co., Brooklyn, 1946. Cloth, 6x9 in., 381 pages. Price $6.*

This subject is of interest to the welding industry because of its effects upon brazing and soldering fluxes. The authors discuss the theoretical aspects of surface tension and its applications in various industrial fields. They have endeavored to present useful information concerning the origin, execution and utilization of surface tension phenomena in the hope that transfer of knowledge from one field to another may help to ease the work of the research or industrial worker. The conclusions they draw are based on their own research as well as on the experiments of others in various industries.

The closing chapters are devoted to the surface tension qualities of various fluxes used in brazing and soldering application. (This is just one example of how the book deals with the diversified branches of industry.) Typical formulas, including formulas for brazing and soldering fluxes, are given to facilitate the formation of emulsions and other products based on the utilization of surface active agents.

A comprehensive alphabetical list of wetting and other surface active agents should interest chemists and other workers in many industries. This list gives the agent's chemical composition, industrial use and the name and address of the manufacturer.

USE EUTECTIC *Low Temperature* WELDING RODS*



Steel table entirely welded without distortion completely eliminating costly finishing, using EutecRod 16.

THIS WELDING JOB ONLY POSSIBLE WITH EUTECTIC

Handle welded to aluminum pan with EutecRod 190. This alloy flows on aluminum like silver solder on brass—no after machining required.

THIS WELDING JOB ONLY POSSIBLE WITH EUTECTIC

Worn armature shaft overlaid with Bronzo-Chrome 185 at 1000°F without burning the insulation or distorting the shaft. Weld is highly wear resistant, but easily machineable.

THIS WELDING JOB ONLY POSSIBLE WITH EUTECTIC

Cracked cast iron cylinder head sealed with EutecRod 15, which is applied at the amazing low heat of 354°—600°F.

THIS WELDING JOB ONLY POSSIBLE WITH EUTECTIC

AVOID THESE WELDING DEFECTS caused by HIGH HEAT!

Distortion and Buckling

Stresses and Cracks

Brittle, therefore Poor Strength

Poor Machinability

Enthusiastic users call it the greatest advance in welding since the invention of the welding torch, as for the first time it is possible to obtain "true welds" without all the disadvantages of high heat.

You can save time and money on jobs and improve the quality of your work with EUTECTIC *Low Temperature* WELDING RODS and FLUXES*. You'll get strong, structurally sound, neat appearing welds that require less machining.

EUTECTIC *Low Temperature* WELDING RODS* are a new type of welding alloys which — 1. *Give a true weld without fusion.* 2. *Bond to base metals well below the melting point of the base metal.* 3. *Form exceedingly strong welds through surface alloying.* 4. *Give faster, better welds at low cost.*

LET EUTECTIC *Low Temperature* WELDING RODS* SOLVE YOUR WELDING PROBLEMS. MAIL THE COUPON OR WRITE ON YOUR COMPANY LETTERHEAD FOR FULL INFORMATION.

Castolin Eutectic

EUTECTIC WELDING ALLOYS CORPORATION

ORIGINATOR OF *Low Temperature* WELDING ALLOYS*

40 WORTH STREET NEW YORK 13, N. Y.

140 Field Engineers in all principal cities of the United States and Canada to serve YOU.

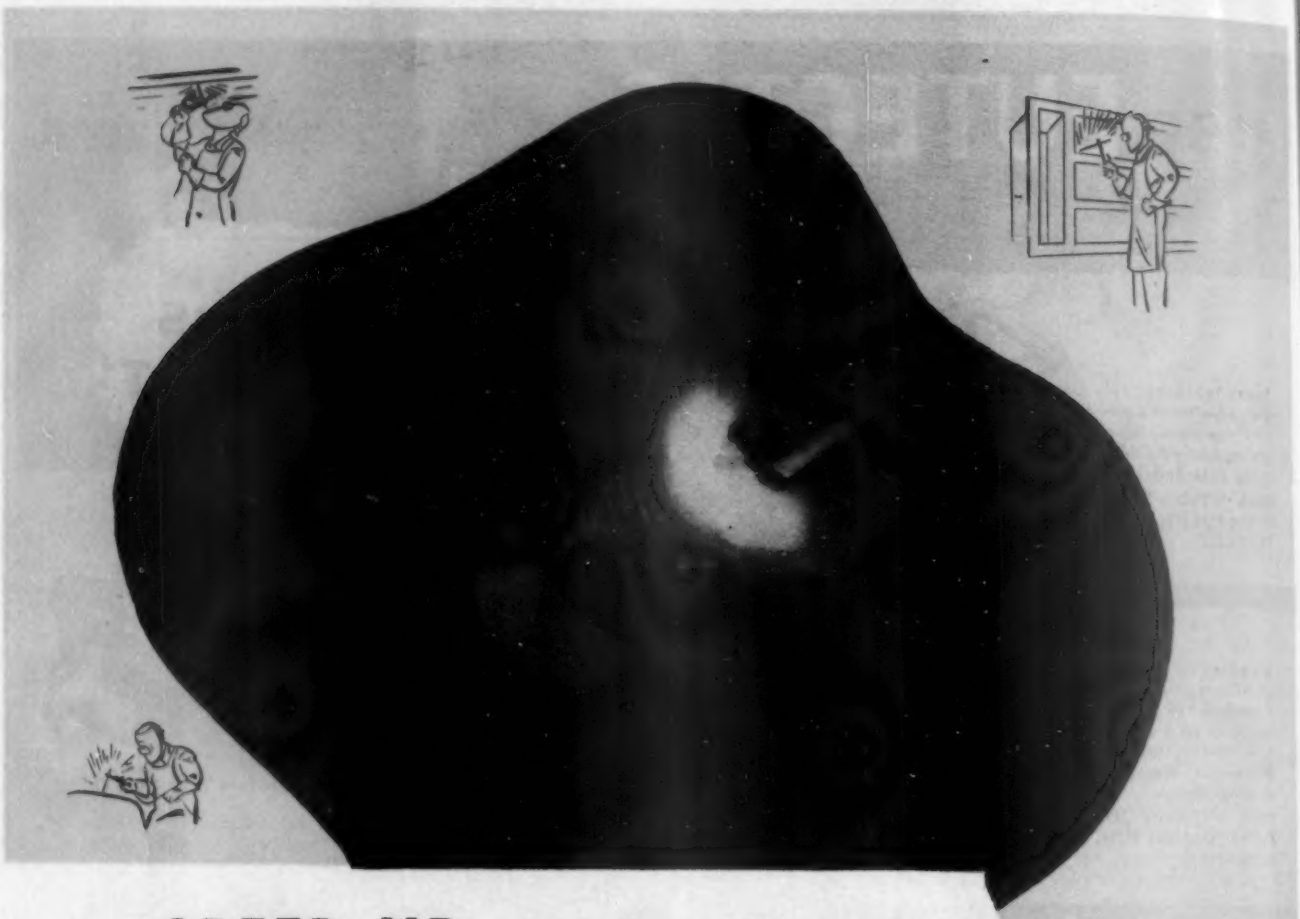
*Trade Mark Reg. U.S. Pat. Off.

Please send me facts on EUTECTIC *Low Temperature* WELDING RODS and Fluxes,* and complete information on how to purchase a trial selection of 9 EutecRods for everyday use. Dept. WE-9.

Name ..... Position .....

Company .....

Address .....



SPEED UP out-of-position welds with 3/16"...

P&H

"AP"
CLASS AWS-ASTM-E6010

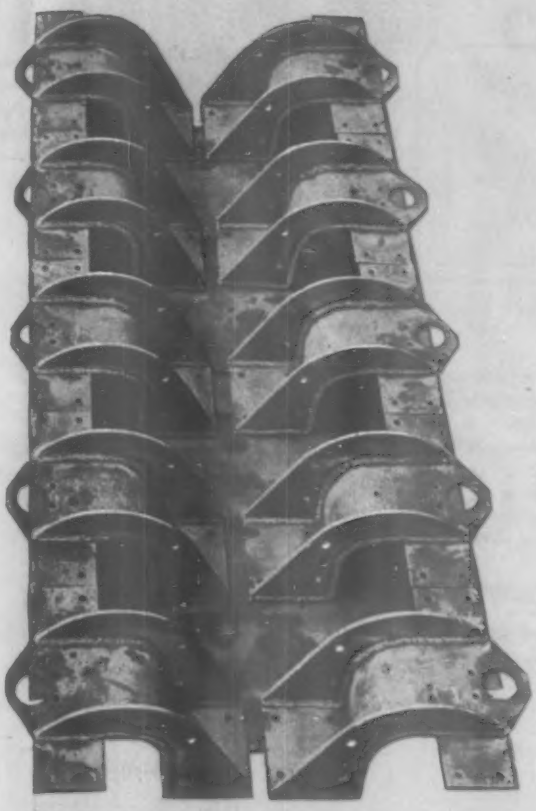
Because of its remarkable versatility, you can use AP size 3/16" in place of 5/32" on all types of joints—in all positions.

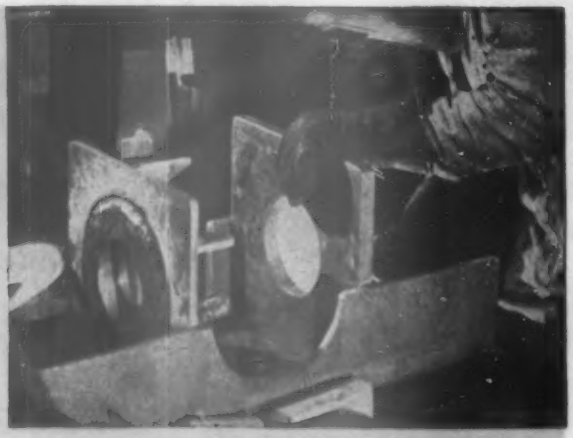
AP is easier to handle . . . it has a fine SPRAY-TYPE ARC. Its DEEP PENETRATION qualities assure strong, lasting bonds and produce X-RAY PERFECT welds. Its unusually LOW SPATTER LOSS means extra footage, increased production. Its exceptionally THIN, EASILY REMOVED SLAG greatly reduces cleaning time. AP gives you all these cost-lowering advantages.

AP also produces good tie-ins and fast, spot penetration without "humps" — it's a PERFECT TACKING ELECTRODE.

If you want lower costs on out-of-position welds, use AP.

Write for Data Sheet Giving Physical Properties, Applications and Procedures





FOR TACK WELDING — in any position—3/16" AP gives perfect results; quick, deep penetration, eliminating humps.

FOR INDUSTRIAL FABRICATION — in volume production, 3/16" AP provides fast downhand deposition and enables the operator to switch to vertical and overhead work without stopping to change electrodes.

FOR PIPE WELDING — here again, 3/16" AP is a big money-saver for butt welding and joining all types of fittings with its smooth-flowing, deep penetrating arc.

CALL YOUR P&H REPRESENTATIVE

ON CONSTRUCTION WORK—3/16" AP ends the need for frequent time-wasting changes to smaller electrodes when working from downhand to out-of-position welds.

P&H makes a production-proved electrode for every welding requirement: for all mild, alloy and stainless steel applications, cast iron and for building up and hard surfacing.

P&H WELDING ELECTRODES

4613 West National Avenue
Milwaukee 14, Wisconsin

HARNISCHFEGER CORPORATION

WELDING ELECTRODES • MOTORS • HOISTS | P&H | ELECTRIC CRANES • ARC WELDERS • EXCAVATORS

AMERICA'S MOST COMPLETE ARC WELDING SERVICE

DC Welders

AC Welders

Welding Electrodes

Welding Positioners

Welding Production Control Systems

Electric Hoists

New Products to Use

To Secure Additional Information, Turn to Page 85

Portable rail-cropping machine. It positions automatically, crops a rail in two cuts

Portable Rail Cropper

1 RAILROAD maintenance-of-way departments now have access to a new portable rail-cropping machine that permits the cutting to be done in the field. The unit consists of two carriage-mounted torches: one on top and one at the bottom. The top torch is adjusted by means of locating holes in the frame for the proper distance above ball of the rail. Two cuts are required to crop a rail. The first cut is made across the ball of the rail and half way down the web. The second cut is made by the bottom torch across the base and up through the web to meet the first cut. A metal cap is used to protect the idle tip when using the opposing tip. The torches are joined by a 5/16 in. hose with tee connections, and both can be operated from a single pair of pressure regulators. The complete machine weighs 61 lbs. and is approximately 38 in. long, 21 in. high and 11½ in. wide. AIR REDUCTION SALES CO., New York City 17.

☆ ☆

Self-Propelled Arc Welder

2 A NEW "Mobile" self-propelled welding outfit, originated to simplify welding operations in the yards of large railway companies, is said to be proving equally useful for maintenance welding operations around oil refineries, steel mills, quarries, gravel pits and industrial plants. The equipment consists of a 300-amp engine-driven generator and carriers for oxygen and acetylene cylinders. A 6-cylinder industrial engine furnishes power for welding and transportation, and a special cable reel permits welding at any desired distance from the machine. The tool chest door, when opened, becomes a convenient work bench.

The unit has automotive transmission connected directly to the welding generator with three speeds forward and one reverse. Fluid drive and a rear-mounted dry disc clutch permit smooth transmission to a transfer case, which may be equipped with one-to-one or two-to-one gear ratios. HOBART BROTHERS CO., Troy 1, O.

Hobart's self-propelled welding set. It takes the welding machine to the job

☆ ☆

Portable insulation resistance tester. A small internal generator supplies the power

Resistance Tester

3 CHECKING of insulation resistance of a-c and d-c equipment should be simplified by the development of a portable resistance tester. This unit weighs approximately 3½ lb and provides its own power by a small internal generator activated by an external hand crank. The correct testing voltage is indicated by two small button lights that glow at 500 volts d-c. Should the crank be turned faster than necessary, an electronic voltage regulator will control the voltage to the meter so that a true reading will be obtained. IDEAL INDUSTRIES, INC., Sycamore, Ill.

☆ ☆

Resistance brazer for welding tubular furniture

Resistance Brazer

4 THE tee-welding of tubular furniture may be facilitated by a new resistance brazer that holds the tubes in water-cooled copper-alloy jaws. A foot switch initiates the timer and contactor which automatically controls the sequence of power. All fluxing is done and the ring of brazing alloy inserted in place before the parts are put into the machine. Removing the excess flux is said to be the only post-weld task required since the brazer produces a smooth, clean joint. ARCO WELDER MFG. CO., Milwaukee 3.

☆ ☆

Self-Hardening Electrode

5 APPLICATIONS such as the hard-facing and building up of worn areas of tractor lugs, shovel teeth, manganese-steel crushing equipment, bulldozer blades, etc. will readily be found for a new extrusion-coated, self-hardening, all-position electrode that is resistant to impact and abrasion. This electrode has the same physical properties as those of the dip-coated electrode of its class but offers a more rapid rate of deposition. It is said to have excellent arc characteristics and to work equally well with either a-c or d-c welders. Other properties are: little tendency to pick up moisture, no slag interference, no loss of hardness or wear resistance on multiple layers, easy slag removal while deposit is still red hot. Manufactured by the STOODY CO., this electrode is available through any AIR REDUCTION SALES CO. dealer.

How many of your welders know what happens inside an arc?

You can show them with 6 of the 55 welding films listed in this new book.

There's nothing like a training film for explaining such details as what goes on inside a welding arc. That's why so many leading welding shops train their welders with the films listed in this book . . . films you can get from manufacturers of welding equipment, film distributors, and government bureaus.

This new book tells you where to get these films . . . which are free . . . which can be rented or bought . . . what they cost.

It describes 55 motion picture and slide films on welding alone . . . covers such subjects as flame cutting, brazing carbide tools, stress relieving, and various forms of welding. In addition there are about 1650 films on other industrial subjects.

You may want to utilize some of these films right away . . . so, write today for your free copy of "The Index of Training Films."

EASTMAN KODAK COMPANY, ROCHESTER 4, N. Y.

Training Films

—another important function of photography

Send in this coupon for *Free* book

Eastman Kodak Company
Rochester 4, N. Y.

Please send my free copy of "The Index of Training Films."

Name_____

Company_____

Street_____

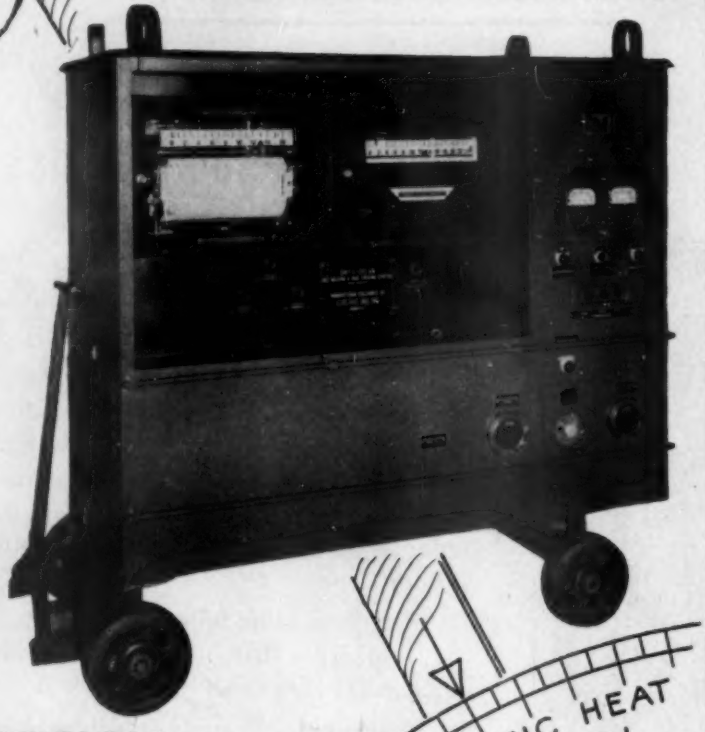
City_____

State_____

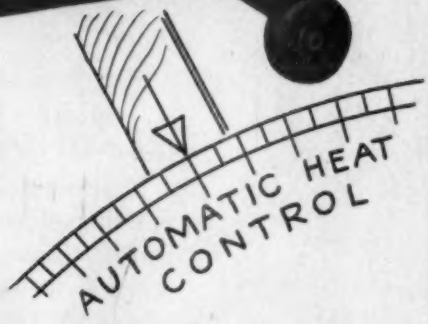
60

Kodak

WELDING
MODERN STEELS
BY
MODERN METHODS
DEMANDS
INDUCTION HEATING



60 KVA Model BH
Induction Heater
with Full Heat
Cycle Program
Control and
6 Point Recorder



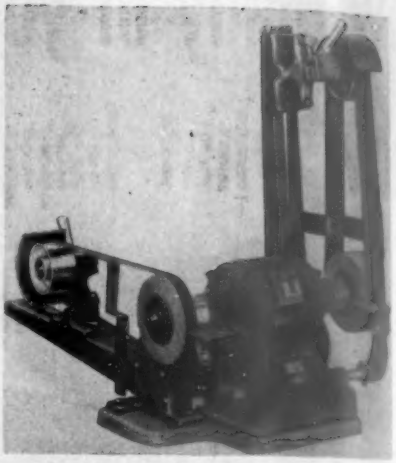
FOR PRECISION
CONTROL OF
HEAT!

INDUCTION HEATING by the SMITH DOLAN SYSTEM
Plus The New HEAT CYCLE PROGRAM CONTROL
Gives all this and more.—Precision control of PREHEATING
FOR WELDING and NORMALIZING AFTER WELDING
is the only efficient method for joining modern alloy steels.

MODERN — SELF-OPERATING — COMPLETE!

Once the metallurgical heat-cycle for the steel has been determined, it is only necessary to set the controls, and the machine shown above will deliver this program from start to finish! In addition, recorded charts keep permanent records for duplication of results. A complete unit for efficient performance. Temperatures up to 1750° F. readily obtainable.

ELECTRIC ARC, Inc.
152-158 Jelliff Ave. Newark 8, New Jersey



Grinder attachment for weld grinding. It may be used on aluminum or other metals

Grinder Attachment

6 A LIGHT, narrow belt-grinder attachment, Porter-Cable type N-2, is capable of performing all kinds of light burring and grinding operations. It is said to be ideal for weld grinding and for light grinding of flats, arcs, angles, etc. The unit stands 27 in. high by 2½ in. wide and is attached to a bench-type wheel grinder. It employes an endless abrasive belt 2 by 48 in. and may be used on either the vertical or horizontal positions or at any angle between them. THE PORTER-CABLE MACHINE CO., Syracuse, N. Y.

☆ ☆

Brazing Rod

7 A NEW metal brazing and soldering rod, "Wow No. 700," has a melting point of 700 F and is said to be capable of handling the field of die-cast white metal, sheet metal and cast aluminum and combination of metals in this category. No flux is needed to produce a solid, dense weld deposit. The size of the rod to be used will depend on the possibility of cracking or warping as well as the required strength of the joint. The thickness or mass of the metal to be brazed determines the size of the torch tip to use. WOW WELDING SPECIALTIES CO., Chicago 12.

☆ ☆

Automatic Welding Head

8 "LAF-2," an improved automatic welding head, accommodates a 3/32 in. electrode and has been designed to simplify production set-ups and increase welding speed. Turning of a switch to the desired position permits the machine to be operated in either the "down" or "up" weld position. Two receptacles are mounted in the automatic control box, and plugs are attached to reduce installation time.

This welding head is normally used in conjunction with a 1,200-amp automatic welder. A current rheostat in the automatic control box permits a current range of 300 to 1,200 amp. THE LINCOLN ELECTRIC CO., Cleveland 1.

Announcing!

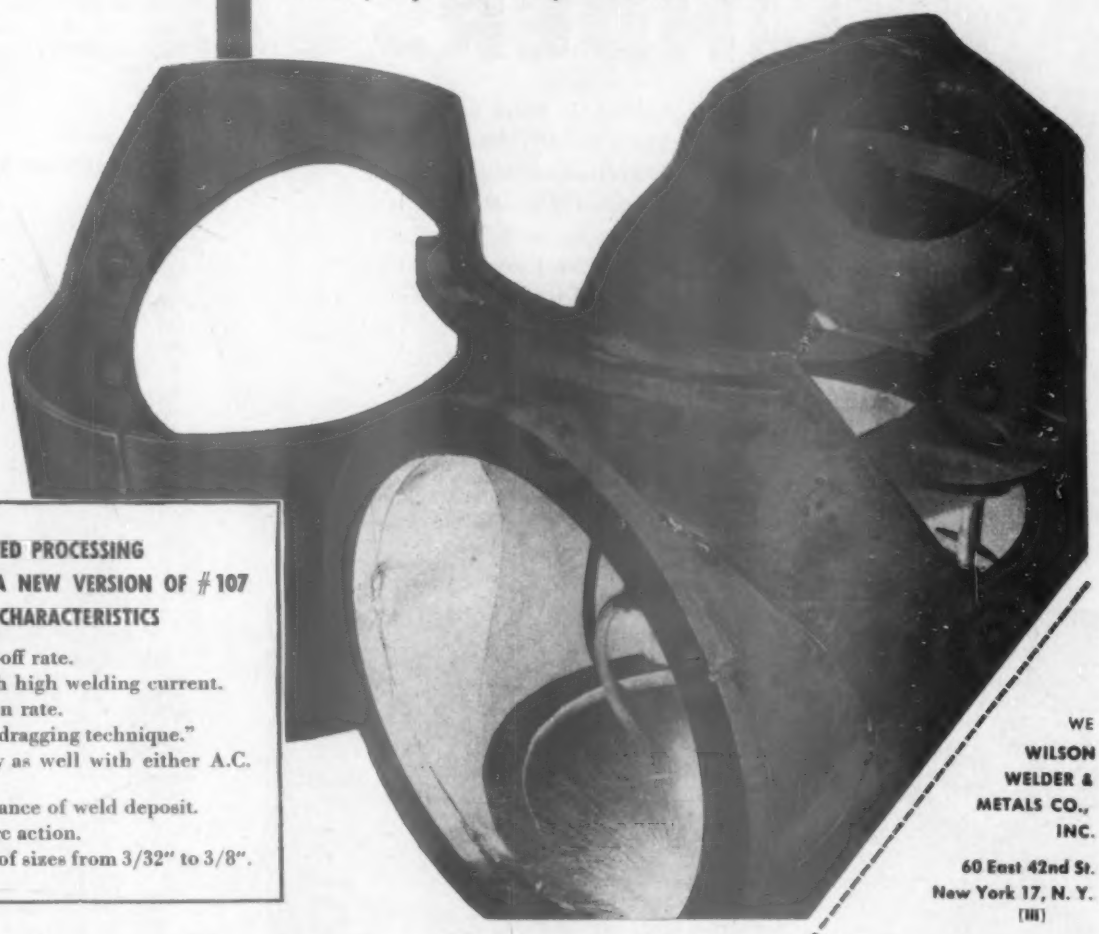
the NEW WILSON NO. 107

(A.W.S. Class. No. E6012)

Now Available in Quantity For ALL-Position Welding of Mild Steel with Poor Fit-Up

The NEW Wilson No. 107 is a general purpose, A.C.-D.C., straight polarity, mild steel rod that produces a weld metal of high mechanical properties. It is especially recommended for low cost, single or multiple pass welding on mild steel plates or sections where the fit-up is poor, or the work is rusty or dirty.

For further data about this exceptional new rod, as well as the complete line of Wilson electrodes, fill in and mail the coupon below. It will bring you a copy of Catalog ADW-75, with our compliments . . . or if you prefer, write your nearest Wilson distributor.



IMPROVED PROCESSING BROUGHT ABOUT A NEW VERSION OF #107 IN THESE CHARACTERISTICS

- Still faster burn-off rate.
- Can be used with high welding current.
- Higher deposition rate.
- Permits use of "dragging technique."
- Operates equally as well with either A.C. or D.C.
- Excellent appearance of weld deposit.
- More forceful arc action.
- Complete range of sizes from 3/32" to 3/8".

WILSON

WILSON WELDER and METALS CO., INC.

General Offices: 60 EAST 42ND STREET, NEW YORK 17, N. Y.

Distributed by: A. M. CASTLE & COMPANY: Chicago, Seattle, Los Angeles, San Francisco; W. P. & R. S. MARS COMPANY: Duluth; KNIGHT & WALL COMPANY: Tampa; ARCOS CORPORATION: Philadelphia; THE CONGDON & CARPENTER COMPANY: Providence; H. BOKER & CO., INC.: New York, Cambridge, Mass.; GRAYBAR ELECTRIC CO., INC.: Pittsburgh, Cleveland, Cincinnati.

Represented Internationally by Airco Export Corporation

WE
WILSON
WELDER &
METALS CO.,
INC.

60 East 42nd St.
New York 17, N. Y.
[111]

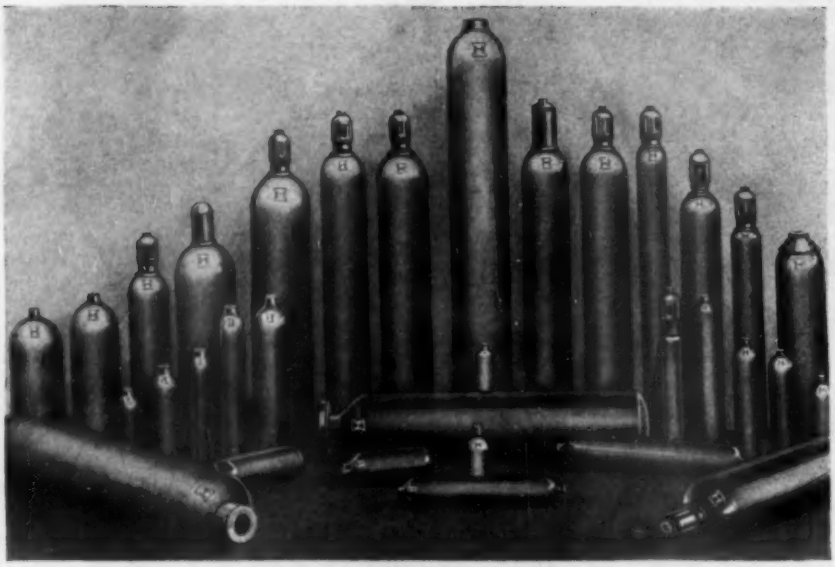
Please send me a copy of Wilson Electrode Catalog ADW-75

Name_____

Firm_____

Address_____

City_____ Zone____ State_____



Harrisburg High Pressure

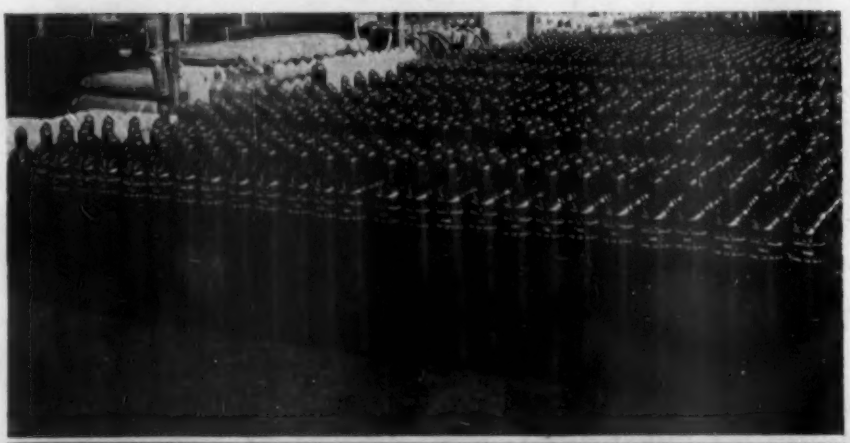
CYLINDERS

Harrisburg Cylinders are Plate-Made. In those few words you get one of the significant reasons why Harrisburg is America's largest producer of Seamless Steel High Pressure Cylinders for the transportation of gases. Plate-Made means maximum uniformity of side walls and bottoms. To give the utmost in strength and precision they are formed from our own steel and processed by carefully designed machinery.

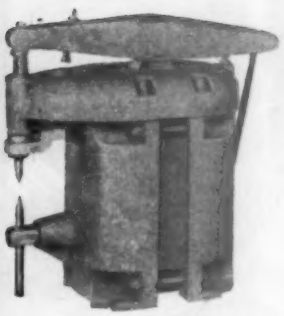
Harrisburg Seamless Steel High Pressure Cylinders can be depended upon because they are built with that "extra margin of quality" to give that "extra margin of safety."

Harrisburg Also Manufactures:

Alloy and Carbon Steels; Seamless Steel CO_2 Liquefiers, Pipe Couplings and Slush Pump Liners; Drop Forgings; Forged Steel Pipe Flanges; Coils and Bends.



HARRISBURG STEEL CORPORATION
HARRISBURG, PENNSYLVANIA



Bench-type welder for light gauge material

Spot Welder

9 A NEW manually operated 1-kva spot welder is being used on such diverse applications as welding copper wire to Inconel, mild-steel wire to mild-steel strips, etc. Operated by a foot pedal, this 46-lb welder has a maximum stroke of 1 in. and a throat depth of 3¼ in. It is featured by a cast aluminum frame and an air-cooled transformer having a laminated copper secondary of sufficient cross-section to allow for high overload capacity. Three ranges of heat regulation are supplied. BANNER PRODUCTS CO., Milwaukee.

Diesel-Driven Arc Welder

10 A Diesel engine-driven arc welder of 300-amp capacity is offered for use in locations where electric power is not available. Dual and remote control permits the operator to make precise voltage and amperage adjustments at the job. There are 1,000 combinations of voltage and amperage to select from.

Hobart's Diesel engine-driven arc welder

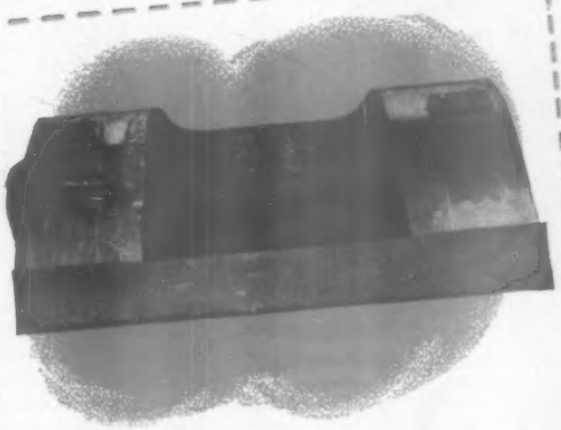
The two-cylinder oil-cooled engine has a 4½ in. bore and a 5 in. stroke and is rated 47 hp at 1,450 rpm. The welding generator has a rating of 300 amp at 40 volts; current range for welding duty is from 20 to 40 volts, 60 to 375 amp. Generator is the single-operator variable-voltage type with 4 laminated main poles and four commutating poles. An oversize 4-pole exciter is built in on the main shaft, insuring quick arc recovery. HOBART BROTHERS CO., Troy, O.

Build up worn iron castings this easy way

HERE'S A NI-ROD REPAIR JOB THAT SHOWS HOW QUICKLY AND EASILY YOU CAN GET STRONG, SOUND, MACHINABLE OVERLAYS

This cast iron draw ring is part of a first-pass die used in the forming of automobile bumpers. Due to an error, it was furnished by the foundry in the soft condition. Hard wear soon beveled the inner corners down to a point of uselessness. An entire new casting was in order. But, the bumper manufacturer didn't want to lose valuable production time while he waited for the new draw ring to arrive. Instead, the worn surfaces were ground down and then rebuilt with Ni-Rod. Ni-Rod electrode is not usually recommended for die build-up, but it did the required job in this case.

Photo shows one side ground down preparatory to welding: the other side already welded.



One . . . two . . . and the job was done, with only a short time lost from production. **NOTE:** the repaired die turned out 10,000 pieces before it was replaced with a properly hardened die. It was still in excellent condition, and the deposits had shown no appreciable wear.

Photo shows one side welded but not yet machined. On the other side, the Ni-Rod overlay has been machined flush.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

WHY YOU CAN USE NI-ROD FOR OVERLAYS

STRENGTH—Ni-Rod deposits are strong and sound, ready to take the same stresses borne by the rest of the working surface.

EXCELLENT FUSION—Ni-Rod overlays are thoroughly bonded to the base metal. In this application, for example, any weakness or cracking at the fusion zone would have soon caused tearing away of the overlays from the parent cast iron.

MACHINABILITY—Ni-Rod deposits can be finished by filing, grinding or machining. Look at the photo of the finished overlay and note the smooth, even surfaces obtained . . . absolutely essential on a die ring.

THERE ARE PLENTY OF JOBS FOR NI-ROD

Smooth-handling Ni-Rod has rapidly become an all-purpose electrode for welding cast iron. It is used in welding shops for the repair of broken or worn castings. In the foundry, for repair of defective castings. In factories, for time- and money-saving maintenance work.

Deposits are smooth, sound, strong, machinable and close to the color of cast iron. Ni-Rod is easy to handle; slight variations in manipulation have no effect on weld quality. Use on a.c. or d.c.

Order a 5-lb. package and give Ni-Rod a trial. Available in 1/8", 5/32" and 3/16" diameters.

Send for Instruction Booklet

NI-ROD IS DISTRIBUTED BY:

WHITEHEAD METAL PRODUCTS COMPANY, INC.
Baltimore, Boston, Buffalo, Newark, New York, Philadelphia, Syracuse
WILLIAMS and COMPANY, INC.....Cincinnati, Cleveland, Columbus, Pittsburgh
STEEL SALES CORP., Chicago, Detroit, Indianapolis, Milwaukee, Minneapolis, St. Louis
PACIFIC METALS COMPANY, LTD.....Los Angeles, San Francisco
J. M. TULL METAL & SUPPLY CO., Atlanta
EAGLE METALS CO.....Portland, Seattle
HENDRIE & BOLTHOFF M. & S. CO., Denver
ROBERT W. BARTRAM.....Montreal
ALLOY METAL SALES, LTD.....Toronto
WILKINSON COMPANY, LTD., Vancouver
METAL GOODS CORPORATION.....Dallas, Houston, New Orleans, Tulsa

"Mainline" welding service kit simplifies maintenance of electrode holders

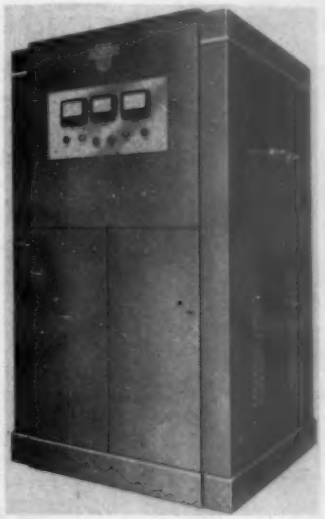
Welding Service Kit

11 "MAINLINE" welding service unit is said to be the answer to the findings of extensive breakdown tests, which determined the proportion of replacement parts that were needed to keep electrode holders in continuous operation. It consists of four "Mor-Weld" electrode holders, two grip handles, four upper jaw insulations, four lower jaw insulations, two lever handles, two springs, one upper jaw, one lower jaw, one connection core, one set screw and one wrench. MOOREWOOD ELECTRIC AND MANUFACTURING CO., Los Angeles 1.

☆ ☆

Induction Heater

12 MODEL "1400" induction heater is capable of delivering an output of 1,400 Btu per minute or approximately 25 kw at a nominal frequency of 375 kilocycles. This heater is suitable for brazing, soft soldering, fusing, hardening, annealing, tempering, stress relieving, forging, melting, etc. It has a full-load input of 50 kva at 90% power factor and operates on a 205-245 volt, 60-cycle, three phase power supply. Installation of a transformer between the line and the generator permits these voltages to be reduced to 220 volts. Other features are water-cooled oscillators, patented time-delay water system, automatic filament stabilizer, instantaneous circuit breaker and a variable output control which allows the power output of the generator to be adjusted from about 10% to full load by means of a single dial. INDUCTION HEATING CORP., New York City 3.



Model "1400" induction heater for brazing, soft soldering, hardening, stress relieving, etc.

☆ ☆

Electrode Holder

13 GARIBAY "350" is a fully insulated electrode holder weighing 17 oz. and having a capacity of 300 amp. Its offset jaws provide a full view of the work and enables use of all of the coated portion of the electrode. Full-throat construction mechanical cable connector and scientific ventilation increases welding efficiency 20%, states manufacturer. GARIBAY MFG. CO., Montebello, Calif.

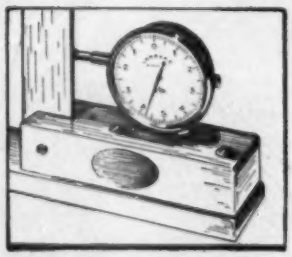
Garibay "350" all-position electrode holder is said to increase welding efficiency 20%

New Micro Square Instantly Checks Right Angles to One 10,000th Inch!

Ideal for precision testing, the Acro Micro-Sine Square quickly and accurately checks right angle work to 1/10,000th inch within a given distance. Its standard indicator dial instantly registers error, location of error, and amount of correction required. Designed for tool and die shops, machine shops and testing laboratories, it also provides a standard for checking master squares, tri-squares and tools.

The Acro Micro-Sine Square is very simple to operate, saves hours of time. Made of hardened tool steel, in ground and lapped precision construction. Available in two types: (1) Standard precision gauge in tenths, (2) Lever indicator in thousandths. Both complete with master checking blocks and carrying cases.

On precision jobs, requiring a static position and mental alertness, workers undergo nervous tension which often results in fatigue. Tests have shown that the act of chewing helps relieve tension—helps workers stay alert, thus increasing their efficiency to do more accurate work. For this reason, many plant owners urge workers to chew Wrigley's Spearmint Gum on this type of job.



Standard Indicator Dial

You can get complete information from Acro Tool and Die Works 4554 Broadway, Chicago 40, Illinois

AA-88

Better..

Better Because of Magic Arc Control

Here's What it Is: Automatic regulation of arc striking voltage through the medium of a special a-c welding circuit . . . *that's* magic arc control — Ampac's key to *better* light gauge welding. Transformer and reactor are combined in an integrated core-coil arrangement . . . providing for a *variable* open circuit voltage. When welding at *low* current settings, the voltage is automatically *raised* . . . but when welding at *high* current settings, the voltage is automatically *reduced*. It's the *ideal* welding circuit . . . and you'll find it in Ampac — the welder with *magic arc control!*

Here's How it Helps You: It makes welding easier and more economical by providing the *correct* arc striking voltage for *every* current setting. With *ordinary* welders, striking and maintaining an arc at low currents is usually *difficult*. But *Ampac* — by stepping up arc striking voltage — makes low current welding *simple*. You get a faster, *easier-to-strike* arc! Illustrated above is a light weight milking stand — *production-welded* on a special jig, then removed for final touches. It's another efficient Ampac *magic arc control* application!

A 2023

HEAR THE BOSTON "POPS": *Every Saturday Evening, American Broadcasting Co.*

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment —
Biggest of All in Range of Industrial Products

Headquarters for all arc welding equipment. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

Silver Brazing Alloys

14 Two new low-temperature silver brazing alloys, "Easy-Flo" 35 and 45, are now available. The former contains 35% silver with a melting range from 1,115 to 1,295 F; it is free flowing at a low temperature, states manufacturer.

"Easy-Flo, 45," contains 45% silver as well as copper, zinc and cadmium, this alloy has a melting range of from 1,120 to 1,145 F and is said to produce strong, leakproof joints between ferrous, nonferrous and dissimilar metals. HANDY & HARMAN, New York City 7.

See Page 85 to Secure New Product Information

Bench Welder

15 THE new Vangtronic stored-energy bench welder was developed to meet the need of a small-size spot welder for welding similar or dissimilar metals and alloys of various thicknesses. The unit operates from 110-120 volt, 60-cycle, a-c power supply at speeds ranging from 30 to 180 spots per minute. Among its several unique features is the use of a "Trignitron," a new type of ignitron tube having two mercury pools ionized by the application of voltage to an external electrode, and an air-core transformer constructed like a solenoid and having a built-in armature to produce follow-up forging pressure.

The brief but intense energy discharge enables the weld to be completed before an appreciable amount of the welding heat has had time to dissipate into the surrounding material. Metals and alloys which can be welded are: aluminum, aluminum alloys, tungsten, platinum, stainless steel, cupro-nickel, nickel silver, etc. THE VANGTRONIC CORP., 87 Washburn Street, Bridgeport 5, Conn.

Air-core transformer spot welder. It speeds stored-energy resistance welding

☆ ☆

Combination Welder Control

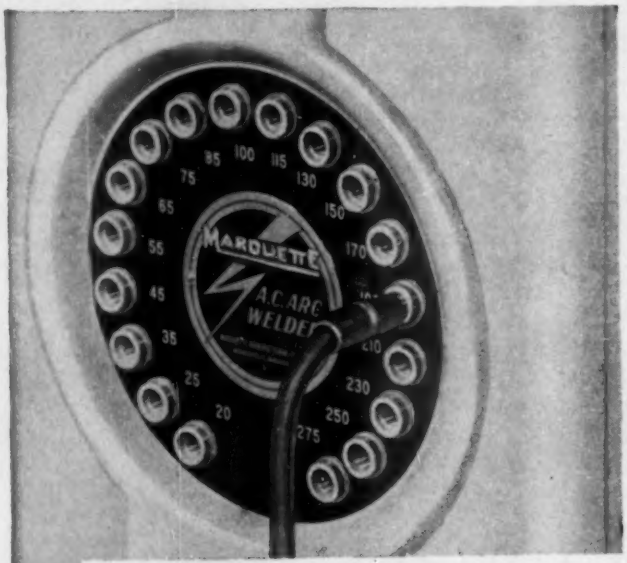
16 FULLY automatic control of air-operated resistance welders is provided in a combination control unit designed to meet recently adopted NEMA standards for resistance-welder control. A "Syncro-Break" welder contractor and a "Safront" sequence-weld timer are both included in a single enclosure arranged to mount on the right side of the machine. Foot switch, pressure switch, no-weld switch and timer control circuits operate at 110 volts.

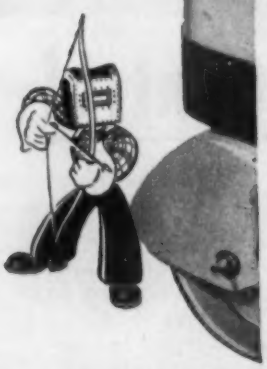
Combination controllers are designed with a control circuit, which may be either separate or common with the power circuit. Solenoid air valve may be energized from either the power or control supply sources by re-connection. Standard controllers have tapped primary control transformers, which can be connected for operation at 110, 220 or 440 volts, 60 cycles; or for 380 volts, 50 cycles. SQUARE D COMPANY, Milwaukee 12.

☆ ☆

Copper Electrode

17 "BERYL-TRODE" is the name of a new copper-base alloy electrode designed to weld parts made of beryllium-copper such as resistance-welding jaws, seam welder wheels, etc. This electrode is also used for brazing broken castings, filling in cracks or building up worn surfaces. It has an arc-stabilizing flux coating and produces a dense deposit that may be heat treated to develop high-hardness, high-strength values. Available in 5/32 in. and 3/16 in. diameters. AMPCO METAL INC., Milwaukee 4.





Hit the Mark in
WELDING PERFORMANCE

★ Instant Arc Striking ★ No "Magnetic Blow" ★ High Power Factor ★ Telnic Bronze plugs and sockets ★ Wide Welding Range ★ Advanced Transformer Design

These are a few of the outstanding features that give the New Marquette A.C. Welders *Superb Welding Performance* on all types of welding. Use these versatile Marquette Welders for High-Speed Production and all Maintenance jobs. Models: 262 and 262 C, 20-275 amps.; 261 and 261 C, 20-200 amps. Write for literature.

MARQUETTE WELDING EQUIPMENT SOLD EXCLUSIVELY THRU THE NATION'S LEADING DISTRIBUTORS

MARQUETTE
REGISTERED U.S. PAT. OFFICE
Welding EQUIPMENT
A.C. ARC WELDERS · ELECTRODES
GAS WELDING And CUTTING EQUIPMENT
ACETYLENE GENERATORS · ACCESSORIES
MARQUETTE MFG. CO. INC.
MINNEAPOLIS 14, MINN.

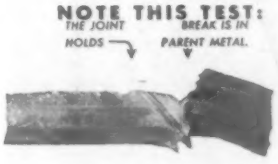
Flash-Welded Aluminum (or Steel) Sash Hits New Production High on Federal Welder

Note that in many cases the two sections mitre joined are not alike either in size or shape.

It's a Federal F4 Flash Welder

Flash Butt Welding Setup ▶

◀ Flash Mitre Welding Setup



THE manufacture of strong, light-weight metal sash received a great impetus when Federal pioneered development of resistance welders to automatically weld butt or mitre joints of intricate cross-sections.

It now takes about one second of welding time to flash a mitre joint stronger than the parent metal on the Federal F4 Flash Welder shown above. It is typical of present day equipment which is helping fabricators of aluminum sash, frames and doors to attain a new high production output. This "four-in-one" machine, equipped with combination cams (a new feature) is adaptable to either aluminum or steel sash, with simple changes of gears and tap settings. In addition, it welds either mitre or butt joints. Alternate setups are made simply by rotating the clamp assemblies as shown in the smaller illustrations.

SEE US AT THE METAL SHOW— Atlantic City, Nov. 18-22

A few of the many special sections now being production welded in aluminum are shown at left. Production rates vary with the cross-section and method of loading, but all are in high output range that makes other methods unprofitable by comparison.

This, as the evidence shows, is the modern way to make metal sash with rigid unbreakable joints, which finish nicely. It is typical of the short-cutting, cost-saving methods possible in all sorts of metal fabrication with the use of Federal resistance welding. It's time to find out how this applies to YOUR production.

THE Federal MACHINE AND WELDER CO.

SUBSIDIARIES
Sammor and Adams Co., Cleveland—SPECIAL HIGH PRECISION MACHINES
The Warren City Mfg. Co., Warren—WARCO PRESSES and PRESS BRAKES

222 DANA ST., WARREN, OHIO

MEMBER R.W.M.A.

On the Job

Weather Made to Order

WIND TUNNELS are becoming commonplace, but the 75-ton all-welded altitude testing chamber illustrated herewith is something out of the ordinary in aviation research. The largest pressure chamber operated by any aircraft company for laboratory experiments, it measures 55 ft long by 17 ft in diameter, can accommodate a full-sized fuselage.

Behind the 21-ton steel door, any desired experimental temperature from 100 F to 200 F can be supplied to test the reactions of aircraft and airmen. Humidity may be controlled to produce ice, snow or sleet as the doctor orders. Almost any degree of air evacuation may be achieved to simulate atmospheres varying from sea level to 60,000 feet in the stratosphere. The conditions of a flying plane are cleverly created by the high-speed recirculation of air.

This unique test chamber was built by the Lacy Mfg. Co., of Los Angeles, to aid research engineers of North American Aviation, Inc., Inglewood, Calif., to learn the new demands to be imposed on planes and passengers as the operating ceilings of aircraft are pushed upward. The main shell (Fig. 1) was fabricated of ⅜-in. boiler plate reinforced by welding on heavy steel hoops spaced at 3-ft intervals. The domed "blind end" was constructed of ⅝-in. plate, formed and welded as shown in Fig. 2.

The massive door assembly, shown to the right of Fig. 1, weighs 21 tons with counterbalances. The smaller door has an air lock, which permits engineers to enter and leave the chamber without disturbing its atmospheric conditions. Three observation ports are located at eye level on each side of the steel tube, while five access glands along the bottom provide for the installation of connections with the testing equipment. The entire chamber is insulated with 9 in. of corkboard applied in 3-in. layers; the first layer is held to the steel wall by the use of welded studs and clips.

The chamber's airtight construction was made possible by arc welding.

☆ ☆

Welding Wrought-Iron Pipe

SEWAGE and salt water make about as bad a combination of corrosive agents as may be imagined. Hence the city of Seagirt, N. J., decided to use extra-heavy wrought-iron pipe to resist the interior and exterior corrosive action on a sewage outfall line.

The fabrication technique employed by the contractor, the Thomas Proctor Co., Inc., Long Branch, N. J., was to couple adjacent lengths of the 12-in. OD pipe with welded long-split sleeves of ½-in. wall thickness Each sleeve measures 30 in. long and is curved to a 14-in. diameter. The sleeves

Courtesy A. M. Byers Co.

This sewage outfall line was assembled by welding split sleeves 30 in. long about abutting ends of the 12-in. wrought-iron pipe

were end-beveled in preparation for welding to the pipe sections.

This construction is not only watertight but provides the strength necessary to meet the stresses imposed by the constant shifting of the sands on which the pipe must be supported.

☆ ☆

Job for Stainless Steel

AN EXTENSIVE system of welded stainless-steel piping is used at the plant of the Celanese Corp. near Bishop, Texas, in the manufacture of chemicals for synthetic fibers and plastics. The various stainless-steel pipes act as "contactors" to introduce two gases to each other—butane and propane. From the properly contrived union of these two petroleum products are begotten such basic industrial chemicals as acetone, acetaldehyde, formaldehyde and acetic acid.

Stainless steel is used for corrosion resistance and to meet the high pressures and temperatures required for reactions. Welding provides gastight and leakproof joints.

Fig. 1—Overall view of the all-welded refrigerated altitude chamber built by the Lacy Mfg. Co., Los Angeles, for North American Aviation, Inc. The 21-ton door assembly is on the right, and the three observation ports and five access glands can be seen along the wall of the 55-ft steel tube

Fig. 2—The "blind end" of the altitude chamber was fabricated by forming ⅝-in. plates, welding them into a domed structure

Photos courtesy of Harnischfeger Corp.

Manganese-steel welded dipper with body made in two pieces, front and back. Four-piece construction is used for dippers of over 2 yd: front, back and two side plates

Welded Steel Dippers

WELDING is being used by the American Manganese Steel Division of the American Brake Shoe Co., Chicago Heights, Ill., to produce a manganese-steel dipper of optimum durability and minimum weight. The extensive use of austenitic manganese steel, termed "the toughest steel known," provides a maximum resistance to fracture and wear.

The dipper was designed with overlapping, rabbeted joints. The edges of the plates are grooved for a welded bead, and the parts are fitted together with round plugs, around which weld metal is likewise deposited. Consequently, the body of the dipper is as strong and homogeneous as if made of one piece; at the same time it is possible to remove a worn front and reweld a new one in place without destroying the back.

This welded-type dipper is being made in capacities of ¾ cu yd and up. Sizes ¾ to 2 yd are made in two body pieces, front and back. Sizes over 2 yd are made in four pieces: front, back and two side plates.

☆ ☆

Resistance-Welding Design

By R. T. Gillette

Works Laboratory, General Electric Co.

IN DESIGNING parts for resistance welding, one of the first things to consider is sufficient overlap so that a weld of proper size may be made on the part without expelling molten metal. A structure should also be designed so the welds are accessible to the welding equipment with as few changes in set-up as possible. It is of considerable help in large structures to do as much welding as possible on subassemblies in order to avoid excessive handling of the final assembly.

Products may be designed to use several types of resistance welding to good advantage. A certain distribution transformer tank, for instance, uses spot, projection, seam and flash welding. The vertical body seam is flash welded. The bushing pockets are first spot welded in the proper locations, then seam welded for oil tightness. The lifting lugs, hangar brackets, cover lugs, nameplate bracket and core clamps are projection welded.

★Superior welds can be obtained by selecting the welding alloy containing those properties best suited to each particular application.

Titan Bronze Welding Rods are double deoxidized to remove all occluded and dissolved gases picked up in melting, increasing ductility and reducing fuming to a minimum. They may be obtained in the following grades:

GROUP I—General purpose rods particularly recommended where high strength and ductile welds are required
PENN BRONZE—Flows at 1628°F.
TITAN BRAZING BRONZE—Flows at 1625°F.

GROUP II—Manganese bronze rods for higher physical properties. General purpose rods recommended for Cast Iron, Cast Steel, other ferrous and some non-ferrous alloys.
TITAN MANGANESE BRONZE—Flows at 1617°F
TITAN NAVAL MANGANESE BRONZE—Flows at 1620°F.

GROUP III—Tin Bronze rods that work very well on cast iron, as well as on other ferrous and some non-ferrous alloys. The welds have good corrosion resistance.
TITAN BRONZE—Flows at 1617°F.
TITAN NAVAL BRONZE—Flows at 1615°F.
TITAN WEARWELL—Flows at 1593°F

WRITE FOR COMPLETE INFORMATION

TITAN Metal
MANUFACTURING CO.
GENERAL OFFICES AND PLANTS
BELLEFONTE, PA.

OFFICES AND AGENCIES
NEW YORK · CHICAGO · SAN FRANCISCO
DETROIT · CLEVELAND · CINCINNATI
ST. LOUIS · TULSA · DENVER
SALT LAKE CITY · ATLANTA · NEW ORLEANS
EXPORT OFFICE: 70 PINE ST., NEW YORK 5, N. Y.

Quality Alloys by Brass Specialists
Brass and Bronze Rod · Forgings · Die Castings · Welding Rods

Welded Trailer Design

AN IDEA in welded trailer design that promises to be a boon to contractors whose automotive equipment consists only of dump trucks is reported by C. W. Lytton, of Franklin, Pa., field welding engineer for The Lincoln Electric Co. This heavy-duty trailer was designed and built by Mead Machine and Iron Works, Warren, Pa. It has a capacity of 11 tons, is 30 ft long and weighs 7,745 lb.

As may be seen in the picture, a fifth wheel has been mounted in the bed of a standard dump truck body. This idea eliminates the need for a tractor to haul the trailer and permits greater maneuverability than is possible with conventional front-wheel trailers.

Courtesy, The Lincoln Electric Co.

A fifth wheel in the truck body eliminates the need for front wheels on this all-welded trailer

In designing the frame, the company's engineers took full advantage of the freedom afforded by welding. The main members are 8 by 8 in. H-beams, and the outside members consist of 8-in. channels. Skid rails are welded to the top section, sides and rear, and bull rings are fused to the frame at convenient positions for securing loads.

The front structure is solidly constructed of H-beams and tubular members. Welding of both the intermittent and continuous types was used at the joints. The welding was done with general-purpose coated mild-steel electrodes.

The trailer platform has a deck height of 29 in. and is 8 ft in width. Ground clearance is 20 in.

☆ ☆

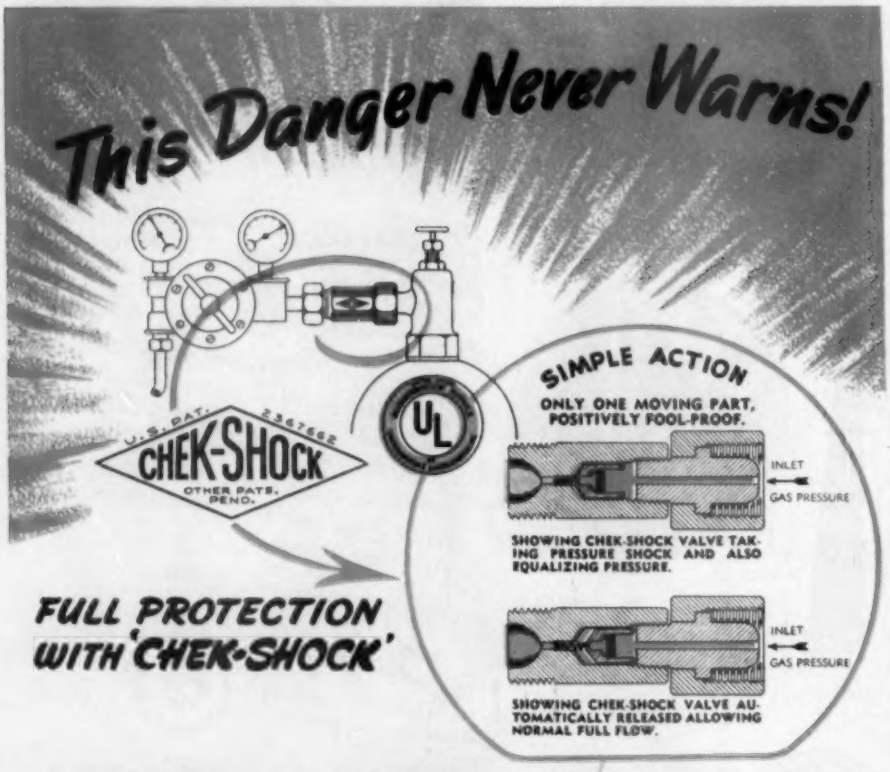
Welded Navy Tugs

FOUR new Diesel-electric harbor tugboats recently assigned to the 11th Naval District were designed with all-steel, all-welded hulls. These vessels were built in the San Pedro yard of the Bethlehem Steel Co., Shipbuilding Div., Terminal Island, Calif. They are designed primarily for harbor and channel service but have the power and seaworthiness for coastal operations.

These tugs are of the YTB 701-704 series, 100-ft overall length with 25-ft beam. Top speed without tow is 12.5 knots, and cruising range is 3,000 miles. Power equipment includes two General Electric d-c propulsion generators, two d-c main exciters (auxiliary generators), two d-c generator-exciters, two d-c propulsion motors and control equipment.

Courtesy General Electric Co.

Diesel-electric harbor tug for the U. S. Navy. Its 100-ft hull is of welded construction



CHEK-SHOCK OXYGEN CUSHION VALVE

SOFTLY controls the vicious "jolt" of high pressure oxygen gas, thus eliminating regulator repairs and preventing possible injury to operators.

- Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.
- Will increase life of regulator assembly.
- Will eliminate possible injury to operator from burstings.
- Will prevent unnecessary internal wear in regulator *(as NOT necessary to release control screw before opening tank valve).*

This PROVEN automatic safety device cushions the initial "blast" of pressure when tank valve is turned on (this uncontrolled surge which strikes like a hammer is the direct cause of most damaged regulators and accidents), when pressure slowly bleeds and equalizes then CHEK-SHOCK allows a full flow of oxygen.

PRICE IS LESS THAN ONE REPAIR BILL

#1. STANDARD COUPLER—for all standard size welding type oxygen regulators.
#2. LIGHT COUPLER—for "airplane" or soldering size oxygen regulators.
#3. HEAVY DUTY COUPLER—recommended for extra heavy duty work only.
#4. SCREW TYPE COUPLER—for removable inlet stem regulators (¼" pipe) available in standard, light, or heavy capacities.
#5. FOR HYDROGEN—left hand thread coupler. We also make Medical Chek-Shocks for all types of medical regulators and tank fittings (chrome plated).... $7.00 each

$6.00 ea.

SEE YOUR DISTRIBUTOR OR WRITE

Chek-Shock MFG. CO.
FOWLER CALIF.

NOW in production

AMPCO-TRODE AC

REG. U. S. PAT. OFF.

the first usable AC-DC shielded-arc bronze electrode

14 reasons why AMPCO-TRODE AC is superior to other bronze electrodes

1. Higher tensile strengths (65,000 — 101,000 psi)
2. Higher yield strengths (35,000 — 69,000 psi)
3. Higher ductility — tensile-strength ratios
4. High hot ductility — not hot short
5. Higher impact strengths
6. Higher fatigue resistance
7. Controllable hardness, from 115 to 300 Brinell
8. Good bearing qualities
9. High wear resistance
10. High corrosion resistance
11. Response to heat treatment
12. Higher strength-weight ratios
13. Retention of physical properties at sub-zero temperatures
14. Retention of physical properties at elevated temperatures up to 750° F.

Now you can successfully use AC transformer-type welding machines (as well as DC generator-type units) on any job that calls for a bronze rod . . .

Ampco-Trode AC welds bronzes, steels, cast and malleable irons, some nickel alloys, and a long list of dissimilar metals. It is the only electrode that successfully welds the aluminum bronzes — developing deposit physical properties equivalent to those of the base metals.

Ampco-Trode AC is easy to manipulate in all positions. The arc is soft and stable, resulting in transfer of the metal in a steady spray action on either AC or DC. The beads feather-edge perfectly into the base metal, and the deposit is free from surface pits. Ampco-Trode AC slag has a low surface-tension, covering the bead completely; this results in perfect protection from atmospheric contamination. After welding, the slag, being brittle, is easily removed with ordinary hand tools — leaving a dense, pit-free deposit with excellent physical properties, and exceptional wear- and corrosion-resisting characteristics.

Write for the new Bulletin W-9.

When ordering, specify "Ampco-Trode AC" to distinguish this new electrode from the original Ampco-Trode . . .

W-93

AMPCO

Ampco-Trode AC is a product of

AMPCO METAL, INC.

Department WE-9, Milwaukee 4, Wisconsin

MANGATONE NM SAVES CALIFORNIA DREDGERS $12,000 A YEAR

★

Mangatone Does It Again!

★

Tuolumne Gold Dredging Co., La Grange, Cal., operating 101 buckets on the line, was spending $15,000 a year in replacements and losing one day in 10 for "clean ups," due to lips of buckets wearing down ¼ inch at center every 10 days. Even more serious was the progressive loss in load and efficiency.

As a test, bucket lips were had-surfaced with a 3/16 pass, 3 in. wide by 30 in. long of Mangatone N. M., with ¼ inch Isorod used as the "hot rod" in the "Two-Tone" application of the Mangatone N. M.

Results of tests showed conclusively that bucket lips hard-surfaced with "Two-Tone" stood up under most gruelling operations Company engineers estimate net saving of $12,000 annually in bucket replacements alone, but consider that a minor saving.

The big factor is that the buckets will be maintained at peak measurements and efficiency, thus producing a full load going into the dredge month after month. This additional "take" in digging will make "the 12 grand look like penny ante."

Write for a copy of Bulletin No. 7, which explains "Two-Tone" process.

RESISTO-LOY CO., GRAND RAPIDS 7, MICH.

ARC WELDING TROUBLE-SHOOTING CHART

Trouble	Cause	Remedy
Welder will not start (Starter not operating)	Power circuit dead.	Check voltage.
	Broken power lead.	Repair.
	Wrong supply voltage.	Check nameplate against supply.
	Open power switches.	Close.
	Blown fuses.	Replace.
	Overload relay tripped.	Let set cool. Remove cause of overloading.
	Open circuit to starter button.	Repair.
	Defective operating coil.	Replace.
	Mechanical obstruction in contactor	Remove.
Welder will not start (Starter operating)	Wrong motor connections.	Check connection diagram.
	Wrong supply voltage.	Check nameplate against supply.
	Rotor stuck.	Try turning by hand.
	Power circuit single-phased.	Replace fuse; repair open line.
	Starter single-phased.	Check contact of starter tips.
	Poor motor connection.	Tighten.
	Open circuit in windings.	Repair.
Starter operates and blows fuse	Fuse too small.	Should be two to three times rated motor current.
	Short circuit in motor connections.	Check starter and motor leads for insulation from ground and from each other.
Welder starts but will not deliver welding current	Wrong direction of rotation.	See INITIAL STARTING.
	Brushes worn or missing.	Check that all brushes bear on commutator with sufficient tension.
	Brush connections loose.	Tighten.
	Open field circuit.	Check connection to rheostat, resistor, and auxiliary brush studs.
	Series field and armature circuit open.	Check with test lamp or bell ringer.
	Wrong driving speed.	Check nameplate against speed of motor or belt drive.
	Dirt, grounding field coils.	Clean and reinsulate.
	Welding terminal shorted.	Electrode holder or cable grounded.
Welder generating but current falls off when welding	Electrode or ground connection loose.	Clean and tighten all connections.
	Poor ground.	Check ground-return circuit.
	Brushes worn off.	Replace with recommended grade. Sand to fit. Blow out carbon dust.
	Weak brush spring pressure.	Replace or readjust brush springs.
	Brush not properly fitted.	Sand brushes to fit.
	Brushes in backwards.	Reverse.
	Wrong brushes used.	Renewal part recommendations.
	Brush pigtails damaged.	Replace brushes.
	Rough or dirty commutator.	Turn down or clean commutator.
	Motor connection single-phased.	Check all connections.
Welder runs but soon stops	Wrong relay heaters.	Renewal part recommendations.
	Welder overloaded.	Considerable overload can be carried only for a short time.
	Duty cycle too high.	Do not operate continually at overload currents.
	Leads too long or too narrow in cross section.	Should be large enough to carry welding current without excessive voltage drop.
	Power circuit single-phased.	Check for one dead fuse or line.
	Ambient temperature too high.	Operate at reduced loads where temperature exceeds 100 F.
	Ventilation blocked.	Check air inlet and exhaust openings.
Welding arc is loud and spatters excessively	Current setting too high.	Check setting and output with ammeter.
	Polarity wrong.	Check polarity, try reversing, or an electrode of opposite polarity.
Welding arc sluggish	Current too low.	Check output, and current recommended for electrode being used.
	Poor connections.	Check all electrode-holder, cable, and ground-cable connections. Strap iron is poor ground return.
	Cable too long or too small.	Check cable voltage drop and change cable.
Touching set gives shock	Frame not grounded.	Ground solidly.
Generator control fails to vary current	Any part of field circuit may be short circuited or open circuited.	Find faulty contact and repair.

Courtesy, General Electric Co.

Los Angeles Times 9 A.M. FINAL

1280-Mile Gas Line Authorized

Project Will Cost $70,000,000 to Bring Texas Fuel Here

A 1280-mile, $70,000,000 pipe line to bring natural gas here from Texas and New Mexico has been authorized by the Federal Power Commission, officials of two gas companies in Los Angeles were informed yesterday.

The pipe-line facilities are designed to meet a developing shortage in the local natural gas supply for 3,500,000 persons in California. F.P.C.

Berkeley Continuous

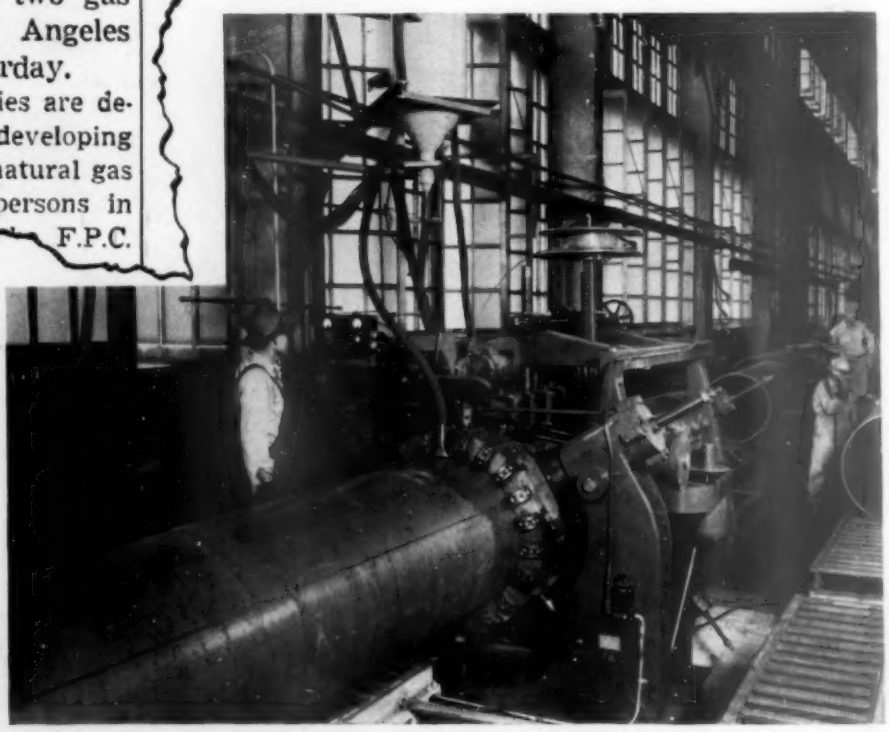
Longitudinal Seam Welders

will weld the seams of the largest diameter pipe line ever authorized

It's a big job to weld the seams of 30" fabricated pipe. It must be done economically and the machines for doing it must be dependable—that's why the Consolidated Steel Corp. selected the 3C Berkeley for this important work. They know it will deliver uniform, high quality welds, continuously day after day.

There's a size "Berkeley" to weld preformed tubes 5" to 36" in diameter.

Write us, we will suggest the best type for your requirements.



Illustrated is a Type 3C "Berkeley" in operation. Machines like this will be used for welding the pipe for this big undertaking.

PENN TOOL & MACHINE CO.

DANVILLE, ILLINOIS

THIS PNEUMATIC TIMER

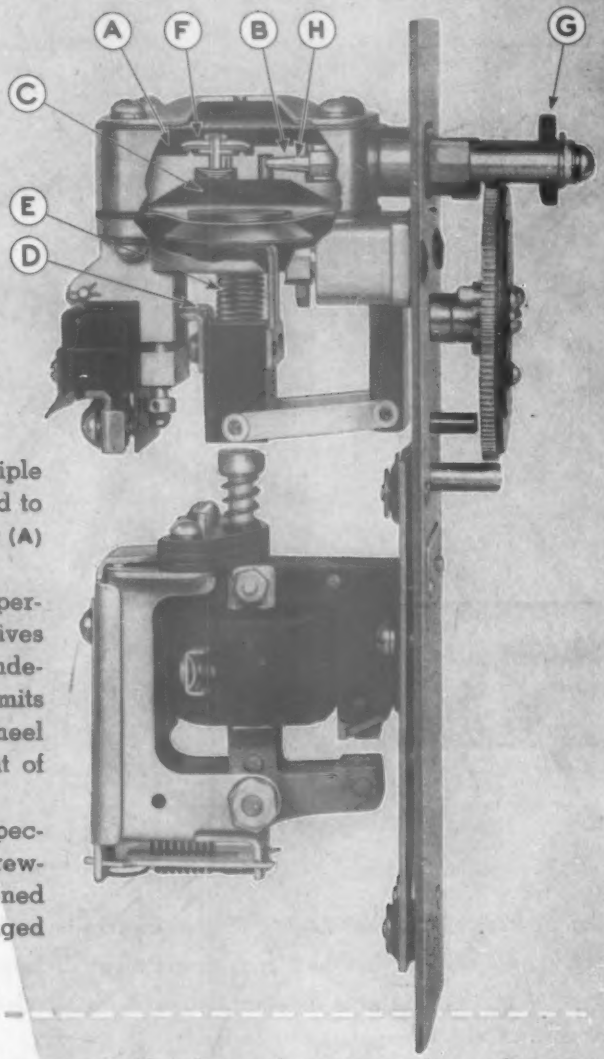
offers 2 outstanding advantages . . .

1

Simplicity **of Design**
makes Safront control easy to understand, install and inspect

2

Accessibility
of operating parts makes maintenance easy for any electrician



• The simple yet unusually accurate operating principle of this timing relay is based on the interval required to transfer a small volume of filtered air from chamber (A) through regulated orifice (B) to chamber (C).

A husky operating magnet supplies mechanical operating power. Contact actuating member (D) receives constant force from spring (E) so that timing is independent of voltage variation. Check valve (F) permits instantaneous resetting. Turning knurled adjusting wheel (G) positions tapered pin (H) to determine amount of restriction in regulated orifice.

All operating parts are instantly accessible. Inspection or maintenance operations require only screwdriver and pliers. Parts subject to wear are hardened and bearings are oil-less. Magnet coils can be exchanged without disturbing calibration.

At left—simplest of the SAFRONT weld timers, the Type TBS-1 controls the duration of welder current flow and is widely used on foot-operated welders. Modernization of existing installations, using the TBS-1 timer and a HIGH SPEED or SYNCRO-BREAK contactor will eliminate the human element, decreasing spoilage and improving weld quality. • Other types of SAFRONT timers use up to six of the basic timing relays, providing completely automatic control of both pressure and power cycles on an air-operated welder. Controls are available for both spot and pulsation welding.

Write **for Class 8991 Safront Bulletin**

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

News of the Industry

Compressed Carbon Aids Resistance Welding

PLANTS located far from high-capacity power lines may now use resistance-welding methods due to the fact that compressed pieces of carbon will conduct electricity better than when not under pressure, it was contended by John D. Gordon, general manager of Progressive Welder Co., at the recent semiannual meeting of the American Society of Mechanical Engineers. One answer to the problem of doing resistance welding in communities not able to meet high demand peaks is the use of battery-operated welders, an application made possible by the "carbon-pile rheostat" to interrupt the enormous low-voltage currents needed by simply releasing the pressure used to press two carbon discs together.

☆ ☆

Research Engineer Develops New Welding Method

KARL SPITZ of Cleveland claims to have developed a new welding method (Pat. pending), applicable to all types of steel, which avoids the harmful deterioration of the steel structure in the weld and heat-affected zones.

The following are a few examples of specific improvements in the weld metallurgy of various steels said to result from the application of Spitz's method.

When welding high-carbon steel (0.75% C.), the weld and the heat-affected zone show a soft, normalized structure, which can be machined and cut by hand with a hacksaw. Welds made by ordinary gas and arc fusion methods show hard and brtitle martensitic structures which cannot be machined.

When welding armor plate by the Spitz method the weld and the heat-affected zones do not show excessive hardness. Welds in stainless steel show improved chemical corrosion resistance, even against aqua regia.

Spitz's welding method also enables improvements in the welding of manganese steels, in the joining of steels of different compositions, and in prevention of the graphitization of steam lines, its inventer claims.

☆ ☆

Army-Navy Specifications Offered for Welding Fluxes

SEVERAL hundred Army-Navy specifications for various products, including magnesium-alloy welding flux, are now on sale in photostat or microfilm form. Each specification describes Army-Navy requirements for material and workmanship, methods of sampling and testing, packing and marking for shipment and other applicable requirements. Inquiries should be addressed to the Reference Service Section, Library and Reports Division, Office of Technical Services, Department of Commerce, Washington 25, D. C.

☆ ☆

General Electric Reorganizes Special Products Division

REORGANIZATION and expansion of General Electric's special products division has resulted in the establishment of four separate sections plus a marketing and promotion group. New section heads appointed are Harrison Johnston IV, laboratory products; S. Martin, Jr., power rectifier; C. W. Bowman, process instrumentation; and D. Lee Chesnut, educational. C. W. Merritt was named to take charge of the promotional activities group.

The new ANDERSON Light-Weight Electrode Holder with the cool handle leads a double life. A single screw is loosened to allow reversal of the insulated head — the head lasts twice as long . . . expense of replacement is cut in half.

A vise-jaw grip, fully protected from spatter, firmly holds up to ¼ inch electrodes. Good balance and a weight of only one pound is achieved by simplicity of construction and a minimum number of parts. A single screw holds it together. Don't let inferior equipment slow you down . . . insist on ANDERSON.

Write today for further information and prices.

DISTRIBUTORS IN PRINCIPAL CITIES

ALBERT & J. M. ANDERSON MFG. CO.
305 A STREET BOSTON 10, MASS.

CLETUNG

ATOMIC HYDROGEN AND HELIARC WELDING RODS

"CLETUNG" Electrodes are a thoroughly engineered highest-purity tungsten product, designed to eliminate crazy arc. Furnished in a wide range of sizes, in lengths as specified for your particular requirements, which will reduce butt losses to a minimum and therefore result in greater economy. Rod surfaces are prepared to give maximum electrical contact with the holder, for highest efficiency. Cleveland-Tungsten welding specialists invite consultation and will gladly lend their experience in the discussion of your problems.

CLETALOY

RESISTANCE WELDING ALLOYS

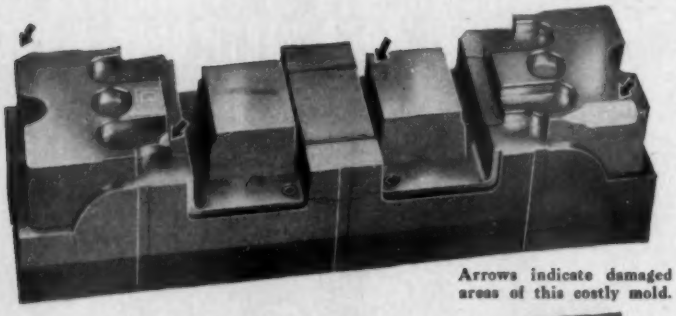
Alloys of Tungsten-Copper, Tungsten-Silver, Molybdenum-Copper and Molybdenum-Silver, for use in resistance welding, are offered under the name "CLETALOY" and precisely varied in composition to meet the requirements of each user. These alloys are made to provide maximum conductivity in relation to hardness. There is a correct formula for each application. Cleveland-Tungsten welding technicians will recommend the grade that meets your exact requirements. Their assistance is available at your request.

CLEVELAND · TUNGSTEN INC.

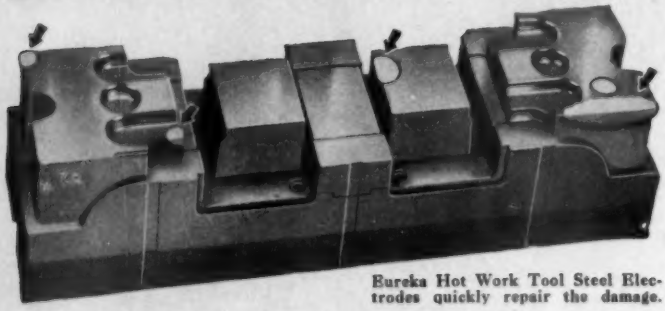
SUBSIDIARY OF MOLYBDENUM CORPORATION OF AMERICA

18200 MEECH AVENUE, CLEVELAND 5, OHIO

Plastic mold saved by welding!



Arrows indicate damaged areas of this costly mold.



Eureka Hot Work Tool Steel Electrodes quickly repair the damage.

The costly mold illustrated above was saved at a small fraction of its replacement cost and was back into operation with only a minimum delay. Eureka Hot Work Tool Steel Electrodes did the job. "Hard-as-welded" deposits have excellent hot-working, air hardening characteristics. Approximate hardness is 50-40 Rockwell C.

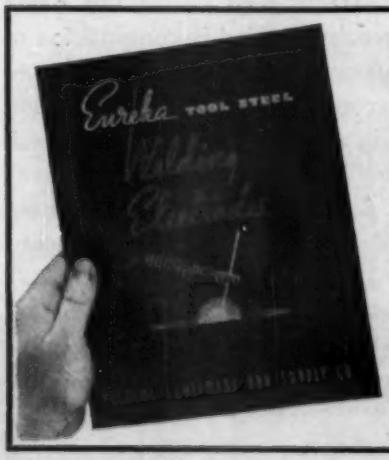
Weld deposits resist abrasion; are exceptionally tough; will withstand erosive action; alternate heating and cooling without fire checking; will not scale excessively. *There is a Eureka Tool and Die Welding Electrode to meet every need.*

EUREKA ELECTRODES

Welding Equipment & Supply Co.

PIONEERS IN TOOL AND DIE WELDING ELECTRODES

223 LEIB STREET • FITZROY 3715 • DETROIT 7, MICHIGAN



FREE *Just clip and mail the coupon below for your free copy of our latest 40-page illustrated booklet, which will help you save many valuable man hours and minimize production delays.*

WELDING EQUIPMENT & SUPPLY CO.
223 LEIB ST.
DETROIT 7, MICHIGAN

Rush me your catalog:

NAME_____

TITLE_____

ADDRESS_____

CITY_____ STATE_____

Publish Selector Chart For Aluminum Alloys

TECHNICAL information concerning 18 of of the most widely used aluminum alloys is presented in an 8½ by 11 in. "selector chart" of the slide-rule type. Operation of the main horizontal slide gives the percentages of twelve elements in the particular and shows physical constants including specific gravity, density, modulus of elasticity in tension and torsion, coefficient of thermal expansion, thermal and electrical conductivity and specific heat.

The second slide is moved vertically to line up the alloy with one of seven different product forms: sheet, plate, wire, rod-bar, shapes, tubing-pipe, forgings. This operation gives the tempers available in that product form, ranges of tensile strength, yield strength, hardness, and elongation. The aluminum alloys covered include 2S, 3S, 14S, 17S, 18S, 24S, Pure-clad 24S, 25S, 32S, A51S, 52S, R353S, 56S, R361, R301, Clad 303 and R317. This chart is available at $1 each from REYNOLDS METALS Co., Department 47, 2500 S. Third Street, Louisville 1.

☆ ☆

Air Products Purchases K-G Welding and Cutting

AIR PRODUCTS, INC., Allentown, Pa., has acquired the 32-year old K.-G. Welding and Cutting Co., Inc. New York City, manufacturer of oxy-acetylene welding and cutting equipment. K-G will continue to operate under that name as a wholly owned subsidiary.

Chester T. Price, chairman of the executive committee of Air Products, has been elected president of K.-G. Welding and Cutting succeeding Philip Kearney, its founder, who will serve in a consulting capacity. George L. Quarles has resigned as a department manager for National Cylinder Gas Co. to become vice-president and general manager of the new subsidiary.

☆ ☆

ASTE Convention October 10 to 12

THE American Society of Tool Engineers will hold its semi-annual convention at the William Penn Hotel, Pittsburgh, on Oct. 10, 11 and 12. Seminars on timely subjects, visits to industrial plants in the Pittsburgh area, showings of engineering films, the Society's semi-annual banquet and many special events make up the comprehensive convention agenda.

A technical session on Thursday afternoon, October 10, under the chairmanship of Stephen Urban of Pratt & Whitney, Syracuse, will be devoted to "Welding and Design."

☆ ☆

Linde Expands at Boise

THE Linde Air Products Co. has started construction of a new oxygen filling station and acetylene-producing plant at Centre Avenue near Owybee Street, Boise, Idaho. This new plant is expected to be completed by the end of this year.

240,000 Pounds Forging Pressure

West Coast's Largest Flash-Butt Welder

The largest flash-butt welder on the west coast, a Taylor-Winfield machine, rates at 800 K.V.A. and has a forging pressure of 240,000 pounds.

This welder will weld either solid bar stock, tubing, structural sections of low carbon, alloy, or stainless steels. An effective cross section area of carbon steel as large as 24 sq. in. or one as small as 1 sq. in. can be welded. The tubing range extends up to lengths of 45 feet and diameters of 12".

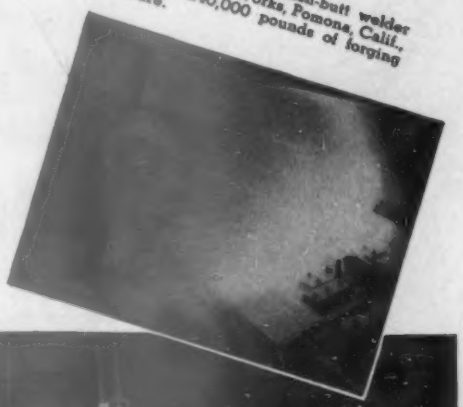
Loud Machine Works, Pomona, Calif., uses this high production welder in the manufacture of oil country products, including tool joints to drill pipe; all sizes of tubing; truck axles of solid ends and tube torque members; and gear blanks.

In your own production, you can effect substantial savings in machining time and material by adapting flash-butt welding for joining two or more simple forgings or stampings to obtain a complicated assembly.

Taylor-Winfield will be glad to assist you in setting up your products and your production line.

Briefs about Flash-Butt Welders

OPERATOR CONVENIENCE
AUTOMATIC OPERATION
GOOD WELD QUALITY
LOW POWER COSTS
FAST OPERATION
MANY SIZES



This Taylor-Winfield flash-butt welder at Loud Machine Works, Pomona, Calif., can exert 240,000 pounds of forging pressure.

Taylor-Winfield makes all sizes of flash-butt welders from 20 to 1200 K.V.A. This welder, the West Coast's largest, has an 800 K.V.A. rating.

Flash welded joint on "pin" end of oil well rotary drill pipe, SAE 3135 to SAE 1040 steel, before removing flash.

The TAYLOR-WINFIELD CORPORATION
WARREN . . . OHIO

THE NAME SYNONYMOUS WITH WELDING CABLE

*SUPER-FLEXIBLE RUBBER COVERED Welding Cable

The Arc Welding Industry voted "MAJOR" Welding Cable their first choice of brand names. The shipyards, ordnance plants and independent arc welding engineers backed their judgment with purchases of hundreds of thousands of feet of "MAJOR" Cable. "MAJOR" is STANDARD—Super Flexible, having a paper separator for quick stripping and attaching to lugs and holder. Spiral winding of fine copper strands in the conductor increases flexibility and insures maximum power transmission. Extruded type rubber covering is maximum oil and abrasion resistance. "MAJOR" is good welding cable.

AT YOUR DEALER OR WRITE . . . WIRE . . . PHONE

WELDING ENGINEERING COMPANY
MANUFACTURERS . . DISTRIBUTORS
MILWAUKEE 2, WISCONSIN
Offices and Agents all over the United States

Mallory Establishes New Detroit Factory

THE NEW Detroit plant of P. R. Mallory & Co., Inc., is now in operation producing special resistance-welding dies, electrodes and allied welding parts fabricated from Mallory alloys. The plant is located at 8605 Livernois Ave., Detroit, and contains 6,400 sq ft of floor space.

Mallory's Detroit staff is headed by A. O. Braun, district manager and O. V. Miller, assistant district manager. Bruce Chatterton, George F. Conway and Earl R. Sayre will contact and lend assistance to users of welding equipment.

☆ ☆

Nelson Appoints British Representatives

MANUFACTURING and distribution rights in the British Isles for Nelson automatic stud welding equipment and flux-filled studs have been acquired by Cooke & Ferguson, Ltd., welding engineers with long experience in the field. Arrangements call for the establishment of complete manufacturing facilities at the firm's headquarters located at Victoria Street, Openshaw, Manchester. The area has been divided into four territories and a field engineering staff, patterned after the Nelson field engineering organization in the United States.

☆ ☆

Create Local Chapters of Engineering Societies

AN Engineering Societies Council has been organized by the local New York chapters of various engineering, scientific and technical societies to render a better coördinated program of meetings and activities. Officers elected are: H. C. R. Carlson, American Society of Mechanical Engineers, chairman; H. P. Wall, American Society of Safety Engineers, vice-chairman; M. P. Davis, American Society for Testing Materials; secretary, H. F. Dart, Institute of Radio Engineers, treasurer.

☆ ☆

Pullman-Standard Welds Stainless-Steel Cars

WORK on the seventh lot of railway passenger cars since V-J Day was begun recently at the Chicago car works plant of Pullman-Standard Car Mfg. Co. These cars will be constructed of welded high-tensile, low-alloy, steel and covered with a stainless-steel sheathing. Maximum strength is thus combined with the decorative effect of the silvery surface.

☆ ☆

Allegheny Steel Moves

THE Allegheny Ludlum Steel Corp. recently moved its executive offices to the Henry W. Oliver Building, Pittsburgh 22, Pa.

FACTS WORTH NOTING

RUFLUX S

FOR WELDING ROD COATING

Known for its arc stabilizing properties—RUFLUX S is a sodium titanate containing approximately 80% TiO_2 and 15% Na_2O. Specific gravity 3.93, mesh size-plus 200, and weight per cubic foot 48 lbs.

Included in welding rod formulation—it aids in speeding welding operations and helps assure proper slag formation.

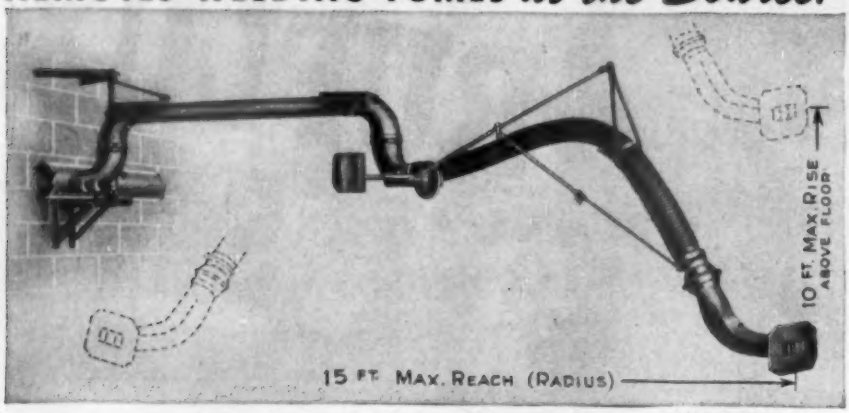
TAM

TITANIUM ALLOY MANUFACTURING COMPANY

Executive Offices: 111 Broadway, New York City General Offices and Works: Niagara Falls, N. Y.

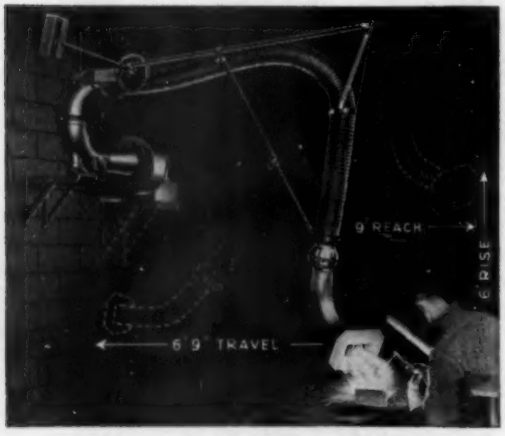
RUEMELIN Fume Collector

REMOVES WELDING FUMES *at the Source!*



PATENTED

LONG REACH MODEL D-5342 — Ideal for large welding booths. Hood reaches out 15 feet from wall. Swivel joints permit inlet hood to revolve in 360° circle for access to all welding positions. Recommended for welding shops having a wide variety of work.



STANDARD MODEL D-5310

Used for standard welding booth ventilation. Hood reaches out 9 feet from wall. A real necessity, especially during winter months when doors and windows are closed.

PATENTED

● Install Ruemelin Fume Collectors to solve your fume removal problem in the most satisfactory manner. Noxious gases, smoke and fumes are drawn away *at the source.* Check these exclusive features:

1. **Guards employee's health against fumes — less welder fatigue.**
2. **Clears shop air with minimum building heat loss.**
3. **Exhaust hood instantly positioned, without using troublesome devices.**
4. **Hood covers maximum welding area, vertically, horizontally and by circle swing.**
5. **Hood equipped with swivelling ball-joint.**
6. **Small amount of electric power used.**

Thousands in daily service in progressive welding shops, metal working plants, railroad repair shops, foundries, structural steel plants, etc. Repeat orders received from many satisfied users. Collectors are available with individual exhaust fans, or with one large fan for multiple collector installations. Engineering data and directions for installing, furnished with each order. Write for Bulletin 37-C and prices.

RUEMELIN MFG. CO.

3880 NORTH PALMER STREET MILWAUKEE 12, WISCONSIN, U. S. A.

MANUFACTURERS AND ENGINEERS

SAND BLAST AND DUST COLLECTING EQUIPMENT

A 4931-2/3

McGraw-Hill Expands Its World News Bureau

FOUR new full-time World News bureaus were recently opened by the McGraw-Hill Publishing Co., Inc., bringing the total number to eight. Regular offices are now maintained in London, Paris, Berlin, Prague, Moscow, Mexico City, Shanghai and Bombay. THE WELDING ENGINEER, as a McGraw-Hill Publication, will be able to take advantage of the expanded facilities to bring its readers welding news from all over the world.

☆ ☆

Alcoa Plans New Die-Castings Plant

ALUMINUM CO. OF AMERICA has filed an application with the Civilian Production Administration for permission to erect a plant in Des Plaines, Ill., for the manufacture of aluminum die castings. According to present plans, the plant will have a floor space of approximately 190,000 sq ft and will employ 400 to 500 workers when manufacturing operations get under way.

☆ ☆

Job Information in New Occupational Abstracts

POSTWAR employment prospects in six occupations including welding are described in six recently published occupational abstracts. These summarize available information on the nature of the work, abilities and training required, earnings, number and distribution of workers, advantages and postwar prospects. Copies may be obtained at 25c each from OCCUPATIONAL INDEX, INC., NEW YORK UNIVERSITY, New York City 5.

☆ ☆

NAF Convention in St. Louis, Sept. 12-14

TEN thousand representatives of management is the goal of the National Association of Foremen at the Twenty-Third annual convention to be held in St. Louis, Sept. 12, 13 and 14. Virtually every phase of present-day problems experienced in industry is scheduled for discussion in 17 sectional conference. Details can be obtained upon request to National Association of Foremen, Convention Headquarters, Forest Park Hotel, St. Louis, or National Office, 11 W. Monument Building, Dayton 2.

☆ ☆

Electrical Show Scheduled in New York Jan. 27-31

THE Electrical Engineering Exposition that was scheduled in 1941 but postponed because of the war will take place in the 71st Regiment Armory in New York, January 27 to 31, 1947. The show will be held in conjunction with the winter convention of the American Institute of Electrical Engineers.

Stoody SELF-HARDENING

The low-cost hard-facing alloy that SAVES LIFE OF ALL EQUIPMENT!

Wherever earth abrasion with impact is encountered STOODY SELF-HARDENING provides the extra protection that keeps all heavy equipment on the job—saves wear and tear, shut-down time and unnecessary replacements!

Now, this low-cost hard-facing alloy is provided with a ***new, extruded flux coating*** that improves all welding characteristics . . . makes it easier and faster to apply. The NEW COATED STOODY SELF-HARDENING surpasses everything in its price class!

Now NEW, EXTRUDED COATING *Improves* EASE OF WELDING!

FEATURES

EXCEPTIONALLY STABLE ARC with either DC or AC machines.

GOOD BOND over a wide range of amperages.

NO SLAG INTERFERENCE.

MORE RAPID DEPOSITION RATE than dipped type electrodes.

CAN BE HANDLED IN ALL POSITIONS.

SOLID, DENSE DEPOSITS with an absolute minimum of porosity.

SELF LIFTING SLAG as deposits cool.

NO LOSS OF HARDNESS OR WEAR RESISTANCE on multiple layers.

GOOD? It's the best yet!

AVAILABLE IN ¼", 3/16", 5/32" and ⅛" ROD DIAMETERS. NO CHANGE IN PRICE.

STOODY COMPANY

1141 WEST SLAUSON AVENUE, WHITTIER, CALIFORNIA

STOODY HARD-FACING ALLOYS

Retard Wear — Save Repair

Perhaps what you don't know won't hurt you...

but surely,

WHAT YOU DO KNOW WILL GUIDE YOU

Selecting welding equipment is a matter of matching as best you can what you want in a welder with what you know a welder can offer. If you want equipment to do a BETTER arc welding job FASTER and at LOWER COST, you can match your requirements perfectly with the right-size G-R welder. Here's why—G-R offers:

G-R Model 59—40-900 amp. range

● Lower Power Costs

G-R's high efficiency (as high as 94.6%, as against 40-50% for generator sets) means you get MORE welding out of every kilowatt of power consumed.

● Faster Welding

Faster welding means HIGHER PRODUCTION—with no magnetic blow, you can use higher heat with faster burn-off and increased rate of deposit to get *more welding done per hour.*

● Better Welding

G-R's smooth, stable, all-position arc assures a better looking and better quality weld.

● Job Proved

G-R is a "job-proved" welder with a record of years of satisfactory performance in job shops, fabrication plants, shipyards, factories.

CONSIDER THE ADVANTAGES of A-C Welding with a G-R

For full information, wire or write

GLENN-ROBERTS COMPANY

2107 ADAMS STREET • INDIANAPOLIS 1, INDIANA
3100 E. TENTH STREET • OAKLAND 1, CALIFORNIA

Ford Spends $10,000,000 in Foundry Reconversion

A considerable portion of the $10,000,000 Ford Motor Co. foundry reconversion program is being spent to provide improved working conditions for the company's 10,000 production foundry employees. Several electric furnaces have been moved to an outside position in the building where objectionable heat and smoke no longer will be a problem. Heat-treating furnaces and welding booths have been moved from the first floor to the second, eliminating superheated floors and faulty ventilation.

☆ ☆

Ryan Awarded Navy Contract

A contract for a metallurgical research program in connection with development of new types of materials suitable for jet power plant and exhaust systems has been placed by the Navy's Bureau of Aeronautics with the metal products division of the Ryan Aeronautical Co. In coöperation with the Navy, Ryan will conduct research work on new high heat-resistant alloys and products fabricated from these materials.

☆ ☆

Linde Expands Amarillo Facilities

An acetylene-producing plant has been built by The Linde Air Products Co. at Amarillo, Tex. Located at N.E. 3rd Avenue and Philadelphia Street, the site also includes a warehouse for the distribution of processed carbide.

☆ ☆

H. K. Porter Moves Its Boston Office

The H. K. Porter Co., Inc., builder of locomotives, and equipment for the processing industries and oil fields, has moved its Boston office to 294 Washington Street, Boston 8.

☆ ☆

New Distributors

Metal & Thermit Corp., New York City 5: (distributors of Murex arc welding electrodes) Pacific Hardware & Steel Co., Inc., San José, Calif.; Miller Welding Supply Co., Grand Rapids, Mich.; Mark Haines, Santa Rosa, Calif.; Wilson Welding Supply Co., Red Bank, N. J.; Arc-Ox Welding Supply Co., Detroit; Harry Jacobs Hardware & Appliances, Davenport, Ia.; Independent Welding Supply Co., Bronx; Muntz & Lee Co., Elgin, Ill.; P. L. P. Distributing Co., Oakland, Calif.; Mineweld Co. of Kentucky, Louisville; Geo. Krause Hardware Co., Lebanon, Pa.; American Compressed Air Products, Inc., Fort Wayne, Ind.; C & F Ornamental Iron Works, Kankakee, Ill.

he knows it is best . . . it's a victor

victor equipment company • 844 folsom street • san francisco 7

Ad 172

About People

GARRET S. PARSONS has returned to the Los Angeles branch office of The Lincoln Electric Co. as welding engineer after three years of Army service. In addition three new welding engineers have joined the company. They are GORDON APPLEBY, Philadelphia office, TERRIL S. HOFFMAN, St. Louis area and E. JAMES LANGHURST, Chicago territory.

☆ ☆

LOUIS R. KOEPNICK has joined Trans World Airline as director of base engineering with headquarters in the TWA overhaul and maintenance base at Fairfax Airport, Kansas City, Kan. He succeeds ROBERT C. LOOMIS, who has been promoted to the post of manager of engineering and overhaul at the Kansas City base.

☆ ☆

WILLIAM H. BASSE and ERNEST L. HARTIG head the retirement list of Joseph T. Ryerson and Son, Inc., steel jobber operating warehouses in eleven cities. Mr. Basse started with the company in 1900 as an office boy and rose to positions of importance in the sales division. Mr. Hartig started in 1902 in the bookkeeping department and rose to the position of vice-president.

C. S. ALLEN, formerly assistant general manager, has been elected vice-president and general manager of the Sawyer Electrical Mfg. Co., Los Angeles.

☆ ☆

IRWIN MCNIECE has been named assistant district superintendent of service and erection for the Allis-Chalmers Mfg. Co. During the last three and one-half years, Mr. McNiece has been working on Allis-Chalmers marine programs in Seattle, Tacoma and Portland shipyards.

☆ ☆

HENRY A. MULLEN, formerly welding engineer at the Willow Run plant of the Ford Motor Co., has been appointed manager of resistance-welding sales for Ampco Metal, Inc.

☆ ☆

FRANK K. MCDANIEL has been elected president of American Bridge Company and Virginia Bridge Company. He succeeds LEON A. PADDOCK, who retires as president of these two U. S. Steel subsidiaris. AUSTIN J. PADDOCK has been elected to replace Mr. McDaniel as vice-president in charge of manufacturing operations of American Bridge. NORMAN B. ORRABD has been appointed vice-president and director in charge of sales of the company. He succeeds EUGENE H. HEALD, retired.

☆ ☆

WALTER C. KERRIGAN has been appointed manager of the nickel sales department of The international Nickel Co., Inc., N. Y. He succeeds the late RUDOLPH L. SUHL. F. W. MASON, JR., formerly associated with The Lithium Co., Newark, has joined the development and research division of the company.

☆ ☆

HERBERT G. AUSTIN has been named district sales manager of the Boston office of Lukens Steel Co. and its subsidiaries, By-Products Steel Corp and Lukenweld, Inc. He succeeds ROBERT H. MCCBACKEN, who has been appointed district manager of sales of Lukens' and By-Products' sales office in Cleveland.

☆ ☆

BERT HOLUB, formerly general sales manager of Ideal Industries, Inc., Sycamore, Ill., recently organized a new firm known as Holub Industries, Inc., 413 DeKalb Ave., Sycamore, Ill. GORDON W. WETZEL, formerly Mr. Holub's assistant at Ideal, has resigned to become sales manager of the new concern.

☆ ☆

P. H. DESROSIERS has been elected executive vice-president and director of Joilette Steel, Ltd., Canadian subsidiary of American Brake Shoe Co.

☆ ☆

ALEXANDER J. CASSITT, vice-president of the Western Saving Fund, was recently elected to the board of directors of the Pennsylvania Salt Manufacturing Co.

☆ ☆

WILLIAM M. SPRINGER has been appointed x-ray products manager in the products department of E. I. DuPont DeNemours and Co., Inc., Delaware. Mr. Springer takes the place of CYRUS A. POOLE, who has been transferred to the sales research division.

☆ ☆

C. C. SMITH has been assigned special headquarters electronics sales representative to the southeastern states for Westinghouse Electric Corp. His territory includes all of North and South Carolina, Georgia, Florida, Alabama and portions of Tennessee, Mississippi and Louisiana.

☆ ☆

VERNON H. VAN DIVER, director of advertising for subsidiaries of Union Carbide and Carbon Corp., has resigned to open his own business as merchandising and advertising counselor with offices in the McGraw-Hill Building, New York City.

☆ ☆

WILLIAM B. KEEN has been appointed superintendent of farm equipment production for Graham-Paige Motors Corp. Mr. Keen takes charge of assembly lines at Willow Run producing Rototiller farm machines.

THE POPULAR RED HEAD ELECTRODE HOLDER

- Stronger Grip
- Any Angle Rod Grip
- Longer Lasting Insulation

Available in the following sizes
300 AMP
400 AMP
500 AMP

★ Low Cost—Simple—Speedy Jaw Replacement
★ More Economical
★ Lighter
★ Better Balanced
★ Rugged

DISTRIBUTORS' INQUIRIES INVITED

IMPORTANT

All 500 amp. Models are supplied with scientifically cooled handles to afford greater comfort to the operator. We invite your test of a 500 amp. Red Head on any job where excessive heat is a problem.

MOTT WELDING PRODUCTS, INC.
13905 MACK AVE. DETROIT 15, MICHIGAN

THIS MITTEN

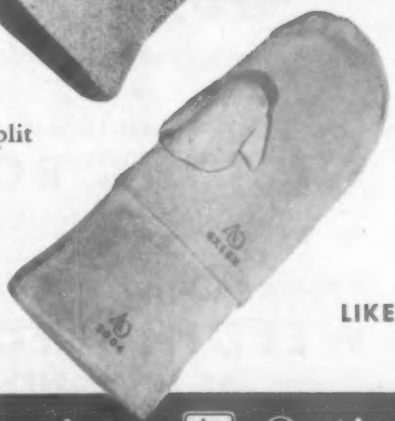
New A-O COVER-MITTS

make mittens last longer

GOES INTO THIS MITT

The new A-O 6X152 Cover-Mitt is designed to fit over welders' full mittens or one-fingered mittens, substantially adding to their life. It is made from split horsehide leather, specially tanned to resist heat and withstand rough wear. Slips on easily.

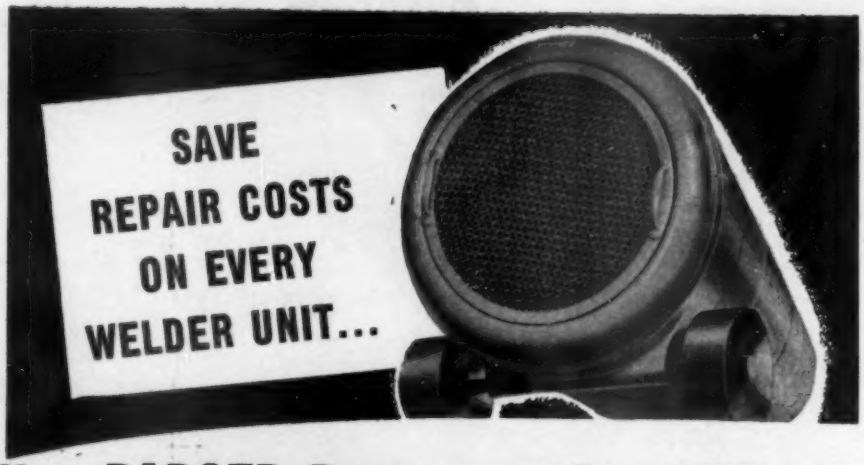
May be ordered in pairs, or all "rights" or all "lefts." Your nearest A-O Safety Representative can supply you.



LIKE THIS

American Optical COMPANY *Safety Division*

SOUTHBRIDGE, MASSACHUSETTS
BRANCHES IN PRINCIPAL CITIES



Use BADGER Permanent Dust Filters

Here are some of the benefits you can enjoy with a BADGER Permanent (Cleanable) Filter on every one of your Welding units . . .

Stop all Process and Atmospheric Dust
Reduce "down-time" and Labor losses
Cuts Brush Replacement Costs
Avoids Repair due to grit and dirt
Double Brush and Rotor Life
Maintains Constant Arc
Keeps Motors Cool
SAVES FILTER COSTS REPEATEDLY

PROVE these benefits on your units! BADGER Permanent Filters are made for all popular Welders—Lincoln, G. E. Hobart, P & H, Westinghouse, Wilson, and others.
Write or wire for full information.

Badger CORPORATION

335 E. Brown St., Milwaukee 12, Wis.

Fuse-Well Cast Welding Rods

THE STANDARD OF QUALITY
Throughout the World

•

CAST ALUMINUM
WELDING RODS
OF STANDARD ANALYSIS

•

PLAIN AND ALLOYED GRAY IRON
WELDING RODS
AND ELECTRODES

THE CHICAGO HARDWARE FOUNDRY CO.
Dependable Since 1897
946 ENGINEERING BUILDING
NORTH CHICAGO, ILLINOIS

SYDNEY L. W. LEA, recently released from the armed services, has been named advertising manager of the Pennsylvania Salt Mfg. Co. He succeeds MRS. ETHEL SERFAS KLINGMAN, retired. ANNE HURLBRINK has been appointed Mr. Lea's assistant.

☆ ☆

ELMER A. SCHWARTZ, formerly of Republic Steel Corp., has been named president of Portsmouth Steel Corp. Mr. Schwartz assumes complete charge of operations for the corporation, which is acquiring the present Portsmouth, O., works of the Wheeling Steel Corp.

☆ ☆

BRAHNA CHALEFMAN HUTCHINS has been elected president of the Safety Research Institute, Inc., educational and public relations organization in various types of safety work.

☆ ☆

THOMAS P. RILEY has been appointed general superintendent of Carnegie-Illinois Steel Corporation's Johnstown-Lorain works at Johnstown, Pa.

☆ ☆

BUCKLEY M. BYERS has been appointed assistant manager of the New York office of A. M. Byers Co., 30 Rockefeller Plaza. Mr. Byers is in charge of export sales.

☆ ☆

J. M. FENNER has been appointed division superintendent, stainless steel, at the Waukegan, Ill., works of the American Steel & Wire Co. RONALD E. GRIFFITHS succeeds Mr. Fenner as supervisor of the research laboratory in Cleveland.

☆ ☆

JOSEPH N. PETERS has been named manager of the carbide and cast-alloy division of the Jessop Steel Co., Washington, Pa.

☆ ☆

HARRY WILSON, JR., formerly vice-president in charge of operations, has been elected first vice-president of the Jessop Steel Co., Washington, Pa.

☆ ☆

W. FRANK KELLY has been appointed general superintendent of foundries for American Manganese Steel Division of American Brake Shoe Co.

☆ ☆

FRANK V. LOCKEFER, formerly sales executive with Rit Products, Inc., has been appointed general sales manager for Mid-States Equipment Corp. Mr. Lockefer will direct sales operations of welding equipment manufactured by the company.

NOW... get "Air-Conditioned" Safety

with CESCO's New Air-Flow Welding Helmets

• Welders wearing CESCO's new *Air-Flow* Helmets stay at their jobs in comfort, under any conditions. Tests in many large plants have proved that production is increased as a result.

CESCO's advanced method of helmet "air-conditioning" washes away fumes and heat . . . reduces worker fatigue. Fresh air is ingeniously supplied by a new, exclusive system of air feeding.

Doctors and safety engineers designed . . . and strongly recommend . . . the new CESCO *Air-Flow* Helmet. Workers welcome it . . . never before have they been assured such safety, comfort and health protection.

CHICAGO EYE SHIELD CO.
2330 WARREN BOULEVARD, CHICAGO 12, ILLINOIS

Get the facts... FREE
Write for this new, illustrated CESCO booklet TODAY

CESCO FOR SAFETY

PACIFIC CARBIDE

High Yield? yes
Uniformity? yes

A tested carbide . . . meeting International and Federal specifications . . . generating acetylene in 12 countries. Standard sizes, in 100-lb. and 500-lb. drums. Location of our plant at Portland, Oregon, permits low-cost delivery to all deep water ports. Address:

Pacific Carbide & Alloys Co.
(Wholly-owned Subsidiary of Stuart Oxygen Co.)
351 California Street, San Francisco 4

Important: **These companies are not connected in any way with any other producer of Carbide.**

Save Money!

('TIS EASIER TO SAVE THE PENNY YE'VE GOT THAN TO EARN THE SHILLING YE HAVEN'T)

with

YORK'S 77
CAST IRON BRAZING
FLUX

1. Fear of overheating can be forgotten.
2. Cleaning and grinding are unnecessary, because "York's 77" penetrates through grease, oxides, etc.
3. Chipping is unnecessary, because a satisfactory bond can be obtained on oxidized surfaces.
4. Deteriorated cast iron can always be welded successfully with "York's 77."

YORK ENGINEERING COMPANY
3349 OGDEN AVE. • CHICAGO 23, ILL.

R. W. GILLMORE has been named manager of a new branch office of the Allis-Chalmers Mfg. Co., opened in the Claremount Hotel Bldg., Evansville, Ind.

ANTHONY LEBESCH has been promoted to assistant general superintendent of the company's No. 1 and 2 grey iron foundries and brass foundries. GUSTAVE HINTZ succeeds Mr. Lebesch as superintendent of the No. 1 grey iron foundry.

☆ ☆

G. J. REKKER has been elected a vice-president of the Ohio Chemical & Mfg. Co., subsidiary of Air Reduction Sales Co. STEPHEN H. NEWBURN succeeds Mr. Rekker as manager of Air Reduction's Detroit district. Succeeding Mr. Newburn as Cleveland district manager is A. C. BROWN, JR., recently returned from the armed services.

☆ ☆

CHARLES R. COX, formerly president of National Tube Co., has been elected president of Carnegie-Illinois Steel Corp. He succeeds JOHN LESTER PERRY, who has become assistant to the president of the U. S. Steel Corp. Succeeding Mr. Cox as president of National Tube is JOHN E. GOBLE. MARCUS J. AURELIUS has been elected sales vice-president of U. S. Steel Supply Co.

☆ ☆

P. D. SCOTT, formerly associated with the Welding Equipment and Supply Co., Detroit, has been appointed general sales manager of the Alloy Rods Co., York, Pa. Mr. Scott will be responsible for the sales of tool steel electrodes, stainless steel and cast iron and other special alloy electrodes.

☆ ☆

DR RUFUS E. ZIMMERMAN, vice-president in charge of research and technology of U. S. Steel Corp., has been elected to receive the American Society for Metals 1946 Medal award for the advancement of research.

☆ ☆

ROBERT P. NICHOLS has been appointed field engineer in the installation department of R. G. LeTourneau, Inc.

☆ ☆

JOHN H. FAUNCE, JR., recently released from the U. S. Navy, has been appointed manager of the new Chicago office of Lukens Steel Co., 332 S. Michigan Ave.

☆ ☆

GEORGE W. WALKER, formerly with the Nash-Kelvinator Corp., has been named automobile design consultant for the Ford Motor Co.

☆ ☆

BRIGADIER GENERAL DONALD ARMSTRONG, recently retired from the Army after thirty-six years of service, has joined the staff of the American Standards Association.

☆ ☆

T. F. DENORMANDIE has been named branch manager of the Buffalo, N. Y. office of the Jessop Steel Co.

Outstanding Design for . . . Outstanding Performance!

RegO Standard Manifolds Combine Major Features to Give You Custom-Built Features

RegO offers a complete line of standard manifolds—wall-mounted and cross-type models in a range of sizes up to the largest for supplying complete pipe systems . . . and, in addition, there's a series of portable styles which provide manifold advantages at low cost and which fully meet the requirements for general use in the field.

Specify RegO Manifolds . . . you will be certain to get the full benefit of engineering know-how which has a background of many years of practical designing and manufacturing experience.

Send for catalog today!

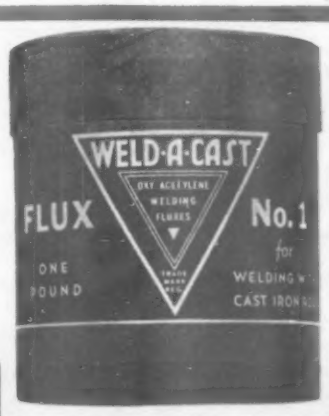
RegO Manifolds for OXYGEN ACETYLENE HYDROGEN NITROGEN and other high pressure gases.

The BASTIAN-BLESSING Company

4201 N. Peterson Ave., Chicago 30, Ill.

Pioneer and Leader in the Design and Manufacture of Precision Equipment For Using and Controlling High Pressure Gases.

REGO



WELD-A-CAST Flux

The old brand is still the best

No. 1. For Welding with Cast Iron Rod.

No. 3. For Brazing and Bronze Welding.

No. 4. For Welding Cast Aluminum.

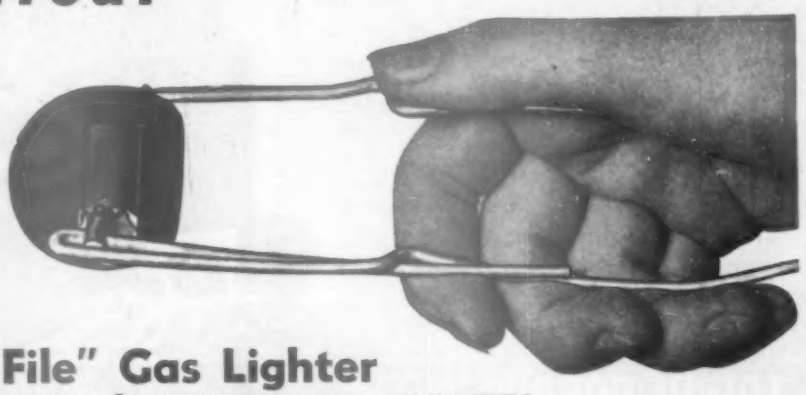
Ask Your Dealer—or write

WELD-A-CAST

CORTLAND WELDING COMPOUND CO.
Cortland, N. Y.

Most Economical

Unrivalled economy is provided by the many superior, exclusive design and construction features of the Improved "Round File" lighter. A large file area is provided—approximately one square inch. **The file is of superior quality, hardened in our own factory. The spark metal is of large diameter and the patented cartridge holding the metal locks exactly into position,** permitting instant replacement. **Every part of the lighter is thoroughly tested.**



The Improved "Round File" Gas Lighter

SAFETY GAS LIGHTER CO. (Est. 1901) LYNN, MASSACHUSETTS

WELDING **PETERSON** BRAZING

"FLUXES OF MERIT"

★ **STICKS TO ROD**—WILL NOT BLOW OFF. SAVES TIME AND ASSURES A BETTER JOB.

★ **CLEANS — FLOWS** TO RUSTY, GREASY, BURNED CAST IRON. CRACKS MAY BE VEED WITH OXYGEN INSTEAD OF GRINDING OR CHIPPING.

★ **BONDS**—ASSURES STRONG BOND TO GROUND OR OXIDIZED SURFACES. No. 3 SPECIAL LOW HEAT—Has same effect as No. 2—at low temperatures. For expansion and contraction problem jobs.

No. 1 BLUE—Welds brass, copper, brazes steel — malleable — cast iron. Exceptional flow and bond on these metals.

No. 5 CAST—Welds cast iron without pinholes or hard spots; makes a soft machinable weld.

SEND FOR SAMPLES
JOBBERS' INQUIRIES INVITED

PETERSON WELDING LABORATORIES
KANSAS CITY 6, MISSOURI

Off the Floor Deliveries!
ON
TRINDL SUPER INDUSTRIAL **ARC WELDER**
DESIGNED FOR HIGH SPEED PRODUCTION ARC WELDING

TRINDL SUPER INDUSTRIAL ARC WELDERS, the result of many years of careful engineering and "job tested" research, are rolling up impressive production records. Acclaimed for superior performance, ruggedness, dependability, and economical operation.

For better, faster welding, easy-to-operate TRINDL SUPER INDUSTRIAL ARC WELDERS will help step up your production schedules 20% to 40%. Manufactured in a range of distinctive sizes to accommodate every type of shop and production welding job.

Trindl Welders, Electrodes, supplies and accessories, available for immediate delivery, will save you both time and money. Write, wire or phone for full details.

TRINDL PRODUCTS, LTD. 17 EAST 23rd STREET AR CHICAGO 16, ILL.

HAROLD T. YOUNGREN, formerly chief of engineering development for Borg-Warner Corp., has been appointed director of engineering for the Ford Motor Co. LEWIS D. CRUSOE, formerly of the Fisher Body division of General Motors, has been named a member of the executive staff of the company.

☆ ☆

JOSEPH H. BELL has been appointed branch manager of the St. Paul, Minn. office of Independent Pneumatic Tool Co. The new office will serve all of Minnesota, eastern portions of North and South Dakota, northwest portion of Wisconsin and the upper peninsula of Michigan.

☆ ☆

DR. EDGAR C. BAIN has been awarded the Albert Sauveur achievement award for 1946 in recognition of his conception of a new approach to the heat-treatment of steel.

☆ ☆

H. K. TRYON has been appointed a member of the sales staff of the new Cleveland office of Lukens and subsidiary, By-Products Steel Corp.

☆ ☆

WARREN J. HOLMES has been named export representative in the Philippine Islands for the Allis-Chalmers Mfg. Co. Mr. Holmes will work with the Earnshaw Docks and Honolulu Iron Works, distributors of heavy industrial equipment for the firm's general machinery division.

☆ ☆

DONALD J. WILL has been elected president of Stuart Oxygen Co. and its subsidiaries. He succeeds PATRICK COYNE, who assumes chairmanship of the entire company.

☆ ☆

RICHARD T. NALLE, executive vice-president of the Midvale Co., was recently elected to the board of directors of the Pennsylvania Salt Mfg. Co.

☆ ☆

LESLIE B. WORTHINGTON has been elected president of U. S. Steel Supply Co. He succeeds ERNEST E. ALDOUS, who retires from the presidency in accordance with the corporation's retirement plan.

☆ ☆

PEM W. TAYLOR has been appointed sales representative of Titan Metal Mfg. Co. for North and South Carolina, Georgia, Florida and Alabama, with offices at 89 Montgomery Ferry Drive, N. E., Atlanta.

☆ ☆

ALEXANDER J. CASSATT, vice-president of the Western Saving Fund, was recently elected to the board of directors of the Pennsylvania Salt Manufacturing Co.

☆ ☆

HAROLD S. WHITE has been appointed head of engine research for the Ford Motor Co. Mr. White brings to Ford a wide background in aircraft and automobile engine research.

Filter Lens—for helmets and shields.
Cover Lens—for cup type goggles.

Are you paying too much for lenses?

• Spending more for lenses than you need to is like throwing money away. Save it, by ordering Amcoweld Protective Lenses that are not only reasonable in cost but also "tops" in quality and service life. All shades—all types (flat, clear and coated) for welders helmets, hand shields, goggles, and spectacles. Prompt delivery. Write for fully descriptive literature and prices.

EASTERN EQUIPMENT COMPANY, Inc.

Industrial Safety Division • Willow Grove, Penna.

MANUFACTURERS OF AMCOWELD PRODUCTS

SPOT • BUTT • ARC
WELDERS

AIR, FOOT or MOTOR Operated Press Type Welders of All Sizes.

We manufacture a complete line of resistance spot welders from ¼ to 300 KVA for all types of welding. There is an EISLER WELDER for every purpose.

Transformers of all types.

We invite contract spot welding in large or small quantities.

Write for Catalog

EISLER ENGINEERING CO.

Address: 749 So. 13th St., (Near Avon Ave.). Newark 3, N. J.

DALLETT PNEUMATIC

SCALING & LIGHT CHIPPING HAMMERS

DALLETT'S line of *Precision Built* Scaling and Light Chipping Hammers features the DALLETT Safety Chisel Retainer Bushing—a safety advantage designed by DALLETT to hold chisel securely, preventing piston from driving it out of hammer.

- PNEUMATIC AND HAND CHISELS
- "DALBO" AIR HOSE COUPLINGS
- "DALLETT" PNEUMATIC SAFETY RETAINER SHANK CHISELS
- "DALWELD" DETACHABLE WELDING CABLE CONNECTORS

Write for Illustrated Bulletin Number 500

DALLETT'S RS Series: Valveless type. Lever throttle control admits smooth, graduated flow of air . . . Exhaust air passes through bushing—blowing away chips or scale. The ideal Tool for removing flux and excess metal from welding operations.

The DALLETT *RS Series* of Weld-Flux Scaling Hammers were especially designed for speeding up welding production. They are light in weight, simple in construction—but are built to take it! First choice of the professional Welder.

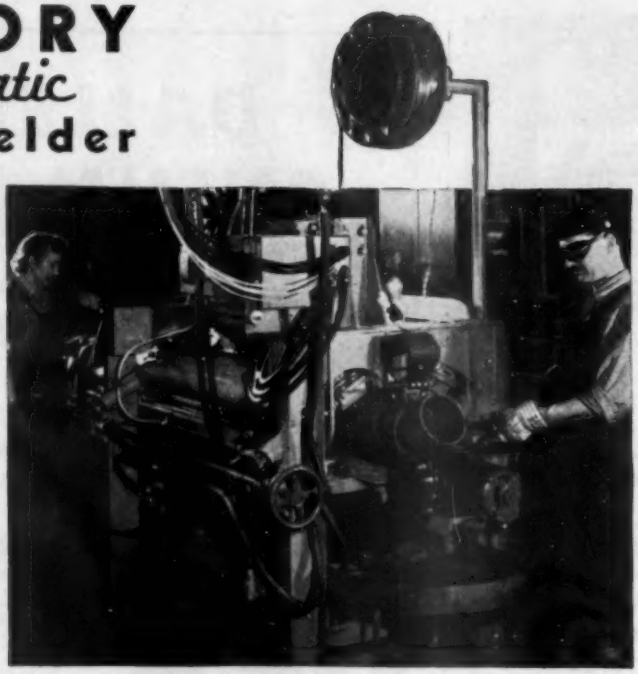
Distributors in principal cities throughout the United States, Canada, Europe, and South America.

THE DALLETT COMPANY

MASCHER AT LIPPINCOTT STREET, PHILADELPHIA 33, PA.

Manufacturers of Pneumatic Tools and Accessories

VICTORY *Automatic* Seam Welder



ACTUAL PHOTOGRAPH OF MODEL 0412 IN USE

Have you considered the opportunities which the VICTORY *Automatic* SEAM WELDER offers you for *low-cost, continuous* production of many types of seam-welded tubing? Century Electric Co, St. Louis, make seam-welded fractional horsepower motor frames at enormously increased rate with this Model 0412 VICTORY *Automatic* SEAM WELDER.

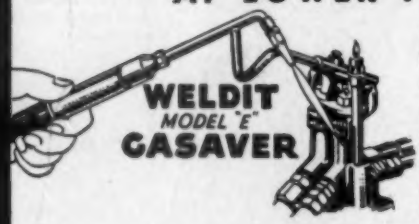
For detailed information regarding this remarkable machine, write, wire or phone—

VICTORY ENGINEERING & MACHINE WORKS, Inc.

3000 Chouteau Ave., St. Louis 3, Mo.

Safe Welding

AT LOWER PRODUCTION COSTS



The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

When the Weldit Gasaver has been installed, you simply hang idle torch on the handy lever rod. Weight of torch pulls rod down, thus automatically shutting off supply lines. Relight instantly by passing torch over Gasaver pilot light. No bother. . . . No time lost. . . . *No readjusting required.* . . . Price $10.00 at Detroit. Order today.

Better Soldering, Annealing and Heating Jobs

The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, menufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

WELDIT INC.

628 BAGLEY AVENUE • DETROIT 26, MICH.

From the Patent Office

Spot-Welding Circuit Welder

2,401,528. Alfred Vang, New York City, assigned to Continental Can Co., Inc., New York City. Filed Jan. 20, 1944. Issued June 4, 1946.

A welding circuit including a transformer having primary and secondary windings and two opposed electrodes, one of which is movable toward the other. The electrodes are connected to the terminal ends of the secondary winding. Other elements are a solenoid for moving the movable electrode toward the other, a condenser, and a mercury-vapor discharge tube. The primary winding, the solenoid, the condenser and the discharge tube are connected in series.

☆ ☆

Magnetic-Particle Inspection

2,401,467. Foster B. Doane, Wilmette, Ill., assigned to Magnaflux Corp., Chicago. Filed May 22, 1939. Issued June 4, 1946.

The method of magnetically testing an object for cracks or other imperfections by subjecting the object to a rotating magnetic field and bringing finely divided paramagnetic particles sufficiently close to the object to adhere adjacent to any cracks or other imperfections providing increased reluctance to magnetic flux. It includes a means for establishing a circular magnetic field about an arbitrary longitudinal axis, means for establishing a magnetic field parallel to the arbitrary longitudinal axis, and two current sources having different time characteristics so as to produce a resultant magnetization continuously changing its direction by angle of at least 90 deg. At least one of these sources varies its current intensity with a frequency sufficiently high to retain the particles on the workpiece over cracks therein. The particles adhering to the workpiece simultaneously indicate cracks in any direction.

☆ ☆

Electrode Holder

2,403,086. Max S. Kenworthy, Portland, Oreg., assigned to C. L. Harsch, Portland, Oreg. Filed April 29, 1944. Issued July 2, 1946.

An electrode holder comprising a pair of spring-opened gripping members pivotally joined together. One of the gripping members is relatively fixed and the other is movable. Coöperating electrode-holding jaws are formed upon the adjacent ends of the members. A manually operable, pivoted handle engages the movable member in order to apply gripping pressure to close the jaws.

High-Frequency Welding

2,400,921. WILLIAM G. DOW, HAROLD C. EARLY, and HENRY J. GOMBERG, Ann Arbor, Mich., assigned to GENERAL MOTORS CORP., Detroit. Filed Sept. 23, 1942. Issued May 28, 1946.

In a method of welding a plurality of electrically conductive members together, the step of applying to the surface of one of the members thin spacers formed at least partially of insulating material to define a certain area. A second member is laid over the surface of the first and on the spacer to provide an electrically conductive means between the contiguous faces of the members within the defined area. High-frequency current is then applied to the two members at a voltage insufficient to cause arcing between them.

☆ ☆

Automatic-Welding Feed

2,402,938. LEONIDAS K. STRINGHAM, University Heights, O., assigned to THE LINCOLN ELECTRIC CO., Cleveland. Filed Julv 13, 1943, and March 17, 1944. Issued June 25, 1946.

In a method of automatic welding a means for supplying granular flux material in a substantially unaccumulated, free-falling stream flowing at a selected rate. The depth of the deposited layer of flux is determined by the rate of relative movement of the welding wire and work.

To Meet
INDUSTRY'S PEACE TIME PRODUCTION PROGRAMS FROM NOW ON—

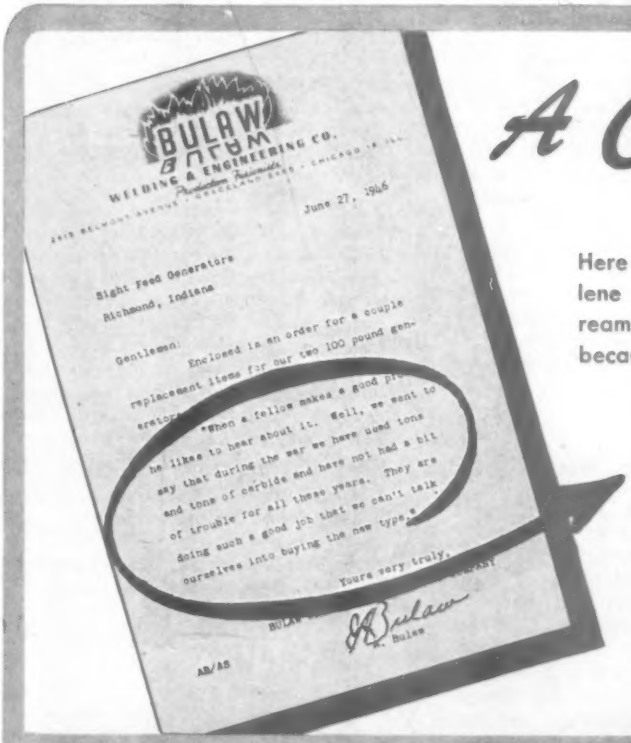
The latest improved shearing methods, so indispensable to all-out war-time production, will continue to be factors of speed and accuracy as industry retools for peace-time activities and expansion. Kling Rotary Shears meet many demands.

- Cut Circles
- Straight Lines
- Cut Rings of large or small radii
- Make Flanges
- Joggles and Offsets
- Cut Odd Shapes
- Bevels, and angle
- Reverse Curves
- Beads, and U's
- Cut Holes, without cutting from edges

KLING Rotary Shears are built for endurance and long-time service. Moreover, skilled labor is not required in their operation.

INVESTIGATE: WRITE TODAY FOR BOOKLET No. 245

Kling Bros. Engineering Works
1319-WE NORTH KOSTNER AVENUE • CHICAGO 51, ILLINOIS


BULAW
WELDING & ENGINEERING CO.
June 27, 1946
Sight Feed Generators
Richmond, Indiana
Gentlemen:
"When a fellow makes a good pr
he likes to hear about it. Well, we want to
say that during the war we have used tons
and tons of carbide and have not had a bit
of trouble for all these years. They are
doing such a good job that we can't talk
ourselves into buying the new type."
Yours very truly,
AB/AS

A Customer Talks!

Here is a letter that says more for Sight Feed Acetylene Generators than our copywriter could say on reams of paper. It says more and it means more because a customer said it.

"When a fellow makes a good product he likes to hear about it. Well, we want to say that during the war we have used tons and tons of carbide and have not had a bit of trouble for all these years. They are doing such a good job that we can't talk ourselves into buying the new type."

ACETYLENE Sight Feed GENERATORS

THE SIGHT FEED GENERATOR COMPANY
RICHMOND, INDIANA

TWO REVOLUTIONARY NEW PRODUCTS by WOW

Made by WELDORS for WELDORS

•

No. 700 ROD

For WELDING
• DIE CAST WHITE METAL
• SHEET and CAST ALUMINUM

•

No. 1 FLUX

For WELDING and BRAZING CAST IRON

THERE is nothing comparable to the No. 700 rod for ease and scope of application. No flux required, no precleaning of the metal, no porosity in the deposit.

No. 1 flux works perfectly with either bronze or cast iron filler rods. Unbeatable for silver brazing stainless steel. No precleaning—does not leave a hard, glossy scale.

Nothing Finer Available

Try them and you'll like them

WRITE US TODAY

WOW
WELDING SPECIALTIES CO.
149 S. WESTERN AVE.
Chicago 12, Ill.

Flux-Cutting Powder

2,402,947. CHARLES J. BURCH, Plainfield, N. J., assigned to THE LINDE AIR PRODUCTS CO. Filed Feb. 6, 1943. Issued July 2, 1946.

A powdered composition for flux flame-cutting containing, by weight, 4 to 36% iron, 28 to 63% manganese, 3 to 19% silicon, 4 to 50% aluminum and 1 to 13% of at least one substance selected from the group consisting of zirconium and calcium. This flux-forming fuel is introduced as a flowing stream in an oxy-fuel flame.

☆ ☆

Brazing Method

2,403,109. MIKE A. MILLER, New Kensington, Pa., assigned to ALUMINUM COMPANY OF AMERICA, Pittsburgh. Filed March 25, 1943. Issued July 2, 1946.

An improvement for the method of brazing that comprises the immersion of the articles to be joined in a bath of molten brazing flux (composed largely of the fluorides and chlorides of the alkali metal and alkaline earth metals) and in contact with a receptacle of nickel or high percentage nickel alloy. The improvement consists in providing the molten flux with a content of nickel particles in amount of about 0.5 to 10% by weight of the total mixture, and immersing the articles to be brazed in the nickel-flux mixture.

☆ ☆

Aluminum-Brazing Alloy

2,403,110. MIKE A. MILLER, New Kensington, Pa., assigned to ALUMINUM COMPANY of AMERICA, Pittsburgh. Filed Oct. 13, 1943. Issued July 2, 1946.

A brazing medium consisting of particles of alkali-metal chloride flux and intermixed particles of aluminum-base alloy at least partially coated with a film of the flux and a pasting agent of non-aqueous organic material. This brazing medium is characterized by a capacity to flow more readily at brazing temperature than a similar medium of like composition in which the alloy particles are uncoated.

☆ ☆

Stud-Welding Method

2,403,438. GROVER A. HUGHES, Seattle, Wash. Filed Sept. 4, 1940, and June 22, 1943. Issued July 9, 1946.

A method of end-welding to a metal body a low-carbon steel stud having a shank and a hemispherical head. There is established between the head of the stud and the point at which it is to be welded an electric arc of suitable strength to effect rapid local fusion of an area as great as the cross-section of the shank but less than the area of the base of the head and to a depth less than the radius of the head. The head is thrust into the fused metal before the latter can drop off. When the heated metal cools, the stud is bonded to the body over an area greater than the cross-section of the shank.

Oxygen and Welding Supply Distributors

Become an independent oxygen manufacturer and earn greater profit!

Don't be a middle-man—become an independent oxygen manufacturer and *earn all of the profit!* Learn what we can do for you before you "buy" cylinders or "service rights" from an oxygen and acetylene manufacturer:

Without any capital investment by you, we are prepared to install a new, patented Air Products, Inc., oxygen generator for you. We will instruct your employees in its operation, maintain it in first-class condition and provide service at regular intervals for efficient, economical and safe operation. This modern complete oxygen producing unit will be leased to you under a long term contract which saves you a capital investment of approximately $25,000 or more. Under our plan *you actually own the oxygen cylinders* and all other facilities except the Air Products, Inc., oxygen producing equipment.

During the war Air Products, Inc. produced a great many new-type oxygen generators for the armed forces. Now they are available for peacetime production of pure, dry oxygen—at low cost and high efficiency. The generator features the exclusive Air Products, Inc. patented oxygen compressing system, which eliminates the need for an oxygen gas-holder, water lubricated oxygen compressor, and oxygen drying equipment.

Write us today giving your estimate of the average number of cubic feet of oxygen you can sell per month. Also the amount of capital you are prepared to invest in this profitable industry. Leases already signed will take up our production for several months. Therefore, we suggest that you arrange a lease now to insure earliest possible installation. This will allow time for you to obtain cylinders, prepare building, etc.

All inquiries will be treated in confidence. Communicate with:

Air Products, Incorporated
Post Office Box 538, Allentown, Penna.
Attn: Chester T. Price
Telephone Emmaus 493

If you are a consumer of oxygen in excess of several hundred thousand cubic feet per month we have a money saving service for you—a service which is now being utilized with complete satisfaction by several very large and internationally known corporations. Inquiries are invited.

ask the welder himself . . .

"CALLITE PURETUNG ELECTRODES are swell for welding light-gauge metals"

- clean, smooth, narrow bead
- better penetration
- no "worm holes"
- carbon-free
- corrosion resistant

In the atomic hydrogen process, silent arcing with Callite Puretung Electrodes gives the operator finer control on light-gauge metals. High temperature of the atomic arc cuts working time on each job and increases output of cleaner, stronger welds. By adjusting the arc fan for variable angles, the operator can easily weld fillet, butt, lap, seam, corner and many other joints with greater speed. No flux is needed.

Callite Puretung Electrodes (99.9% pure tungsten) are widely employed in atomic hydrogen, helium and argon arc welding processes. Uniform high purity resists intense arc heat; electrodes consume slowly. Deposits are entirely free from spatter and scale, eliminating costly grinding and finishing. Write for descriptive Bulletin No. 154. Callite Tungsten Corporation, 549 Thirty-ninth Street, Union City, New Jersey. Branch Offices: Chicago, Cleveland.

Callite PURETUNG ELECTRODES

CALLITE TUNGSTEN CORPORATION CT

Standard and special-polished, clean and black; 7 standard diameters, 12-inch lengths; random lengths and other diameters on special order.

FOR 26 YEARS PIONEERS IN TUNGSTEN METALLURGY

Your WELDING JOBS Are Done

FASTER EASIER BETTER

when you use . . .

Mid-States METAL ZIPPER

Do your welding jobs faster, easier, better and make more money . . . with Mid-States Metal ZIPPER, world's finest arc welder! Packed with exclusive features! Extremely easy to operate! Outperforms anything in the welding field, yet costs no more. Get the most for your welder dollar . . . get a Metal ZIPPER!

See your jobber or write for complete details, now!

Mid-States EQUIPMENT CORP.

2429 SOUTH MICHIGAN AVENUE, CHICAGO 16, ILLINOIS

The RIGHT FLUX for the JOB . . .

FLUXINE No. 2 for brazing and bronze welding—copper, copper alloys, malleable iron and steel.

FLUXINE No. 5 for gas welding steel with bare rods.

FLUXINE No. 6 . . . non-glaring . . . for bronze bonding—cast and gray iron with bronze and nickel alloy rods.

FLUXINE No. 18 for gas and atomic hydrogen welding of stainless steels and inconel.

FLUXINE No. 41 used with high-melting silver solders on copper and its alloys and on steel.

FLUXINE No. 42 used with Westinghouse Phos-Copper rods and low-melting silver solders on copper and its alloys.

FLUXINE No. 43 . . . non-glaring . . . used whenever low-melting silver solders are specified. No injurious fumes.

Wherever a flux is required "FLUXINE" Fluxes will do it better and more economically. Write us on company letterhead for sample stating your flux problem. Address Dept. G.

Better jobbers everywhere carry the "FLUXINE" line.

KREMBS & COMPANY

Est. 1875

669 West Ohio Street, Chicago 10, Ill.

FLUXINE

TRADE MARK REGISTERED U. S. PAT. OFF.

. . . IN MODERN SCHOOL

It's a beautiful steel building, built especially for Welding instruction. Each student has his own individual welding booth and personal arc welder. Large, airy rooms for classroom instruction periods. Reference books, head shields and protective clothing issued to every student.

. . . WITH EXPERT INSTRUCTORS

The teachers are expert arc weldors who have had many years of practical arc welding experience. They keep up on modern welding techniques and pass them on to the students.

. . . UNDER THE G. I. BILL

The Hobart Trade School is fully qualified under the G.I. Bill, and service veterans are welcomed to its classes. Established years ago, the school is not a World War II offspring.

COMPLETE COURSE —

The course of instruction is complete and intensive. Welding is taught in all its phases, arc, alloy and carbon arc, acetylene and flame, helium, stud, automatic, resistance and metal spraying.

GOOD WELDORS IN DEMAND!

All over the country, manufacturers are clamoring for more arc weldors. It's one of the highest paid industrial jobs available today — send the coupon below for further details.

HOBART TRADE SCHOOL, INC.

Box U96 **Troy, Ohio**

HOBART TRADE SCHOOL, Box U96, Troy, O.
Send more details about your welding school. I've checked my status for entrance below:
☐ Veteran ☐ Non-veteran

NAME _____

ADDRESS _____

CITY _____ STATE _____

Flash-Welding Method

2,401,243. William C. Heath, Shorewood, Wis., assigned to A. O. Smith Corp., Milwaukee. Filed April 9, 1943. Issued May 28, 1946.

A method for the flash welding of parts difficult to assemble and requiring a set-up time unreasonably long relative to the welding cycle. The time of the welding machine is conserved for welding by assembling the opposed work parts externally in separate portable packages clamping them by electrode dies under welding contact pressure. A plurality of such packages containing the opposing work parts can be transferred to a flash welder with the packages in movable supports so that the edges to be welded are disposed in alignment for welding. The packages are removed as a unit from the machine and disassembled to free the welding dies for successive welding operations.

☆ ☆

Jig for Butt Welding

2,402,178. Leif Nilssen, Westerleigh, Staten Island, N. Y., and Salvatore Joseph Finelli, Rahway, N. J., assigned to Foster Wheeler Corp., New York City. Filed Dec. 29, 1943. Issued June 18, 1946.

A jig for resistance butt welding comprising a tubular work-holding member having separate contacts at its inner peripheral portion. The contacts are disposed so as to engage the edges of the articles to be welded and connected to opposite sides of the welding circuit.

☆ ☆

Automatic-Welding Process

2,402,165. Robert E. Kinkead, Shaker Heights, O. Filed Aug. 13, 1941. Issued June 18, 1946.

A process of metal-arc welding in which a shield of gases containing arc-ionizing ingredients is maintained around the arc. The arc is progressed along the piece to be welded and surrounded with slag-forming material in particles large enough to permit the gas of the shield to escape without displacing the slag from the vicinity of the arc. The slag-forming particles are small enough to be fused by the heat of the arc.

☆ ☆

Flash Welder

2,403,229. Thomas E. Murray, Southampton, George H. Phelps, Floral Park, and George Frischmann, Queens Village, N. Y., assigned to Yarrum, Inc., Brooklyn, and Murray Mfg. Corp., Brooklyn. Filed Feb. 12, 1942. Issued July 2, 1946.

A flash welder comprising electrodes for engaging the pieces to be welded, and means for removing the burr extruded during the welding. The latter includes a cutting tool and a tool holder that is moved transversely of the movement toward the electrodes. There is also a means for effecting angular movement of the tool holder.

"FOR A SMOOTH WORKING EASY HANDLING CAST IRON WELDING ELECTRODE, GET AGILE YELLOW!"
"I HEAR THAT YOU DON'T HAVE TO PRE-HEAT EITHER"

Agile

YELLOW

CAST-IRON WELDING ELECTRODES

100% returns for a small investment. Costly production breakdowns due to the failure of cast iron castings can be quickly reduced by welding the broken casting with Agile Yellow. The weld is dense, file soft, and the color matches the casting.

SEND FOR CATALOG TODAY!

AGILE ACTARC

AMERICAN AGILE CORPORATION

5806 HOUGH AVE. · CLEVELAND 3, OHIO

For CLAMPING PARTS of Varying Thicknesses

Don't waste time making manual adjustments; thickness variations up to ¼-inch are taken care of automatically when your clamp is fitted with a

Pressure-Matic Assembly

By means of a heavy compression die spring, the hold-down spindle automatically adjusts itself to the thickness of work or part being held, maintaining positive pressure. Assembly is welded to work bar. Types for medium and heavy duty De-Sta-Co Clamps.

Described in De - Sta - Co Clamp Catalog No. 45. Send for a Copy.

DETROIT STAMPING CO.

Established Over 30 Years

372 Midland Ave • Detroit 3, Mich.

GREYHOUND

FARM WELDERS

WITH A NEW GREYHOUND

you have an indefinite number of correct heats at your fingertips, with a slight twist of the handle conveniently located on top of the Welder.

• • •

INSTANT ARC STRIKING without extra gadgets.

• • •

Power Factor Correction meets REA and Rural requirements.

• • •

Greyhound Welders sold exclusively thru Distributors in the U. S. and foreign countries.

GREYHOUND A. C. ARC WELDER CORP.
604-606 Johnson Ave., Brooklyn 6, N. Y.

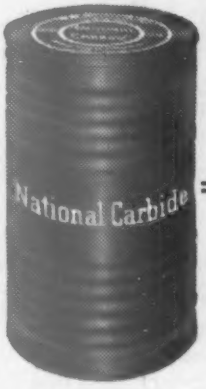
Builders of

Positioners and Fixtures

for Manual and Automatic Welding

BENTLEY WELDING, Inc.
Teall Ave. and Riegel St.
SYRACUSE, N. Y.

National Carbide



• EFFICIENT
ECONOMICAL
DEPENDABLE •

For Welding and Cutting *Specify*

NATIONAL CARBIDE IN THE RED DRUM

Write us for information as to nearest available stock.

NATIONAL CARBIDE CORPORATION
60 E. 42nd St., New York 17, N. Y.

Fluxes cost SO LITTLE yet are SO IMPORTANT

Use only those GOOD Guaranteed

"ANTI-BORAX" FLUXES

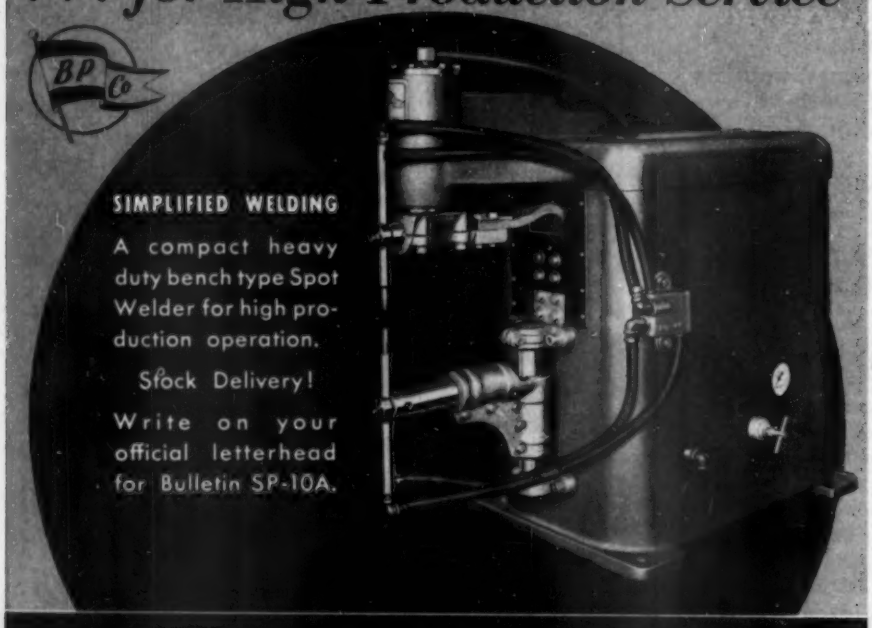
No. 1 Cast Iron Welding Flux.
No. 2 Brazing Flux for Brass, Bronze, etc.
No. 4 "Bras-Cast" Flux for Bronze Welding Cast Iron.
No. 5 Aluminum Flux for Cast Aluminum.
No. 8 Aluminum Flux for Sheet Aluminum.
No. 9 Stainless Steel Welding Flux.
No. 11 Tinning Compound.
No. 16 Silver Solder Paste Flux.

Send for Free Samples

MANUFACTURED ONLY BY

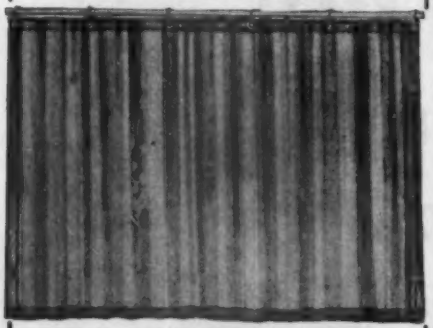
ANTI-BORAX COMPOUND CO., Fort Wayne, Ind.

Banner 10-15 KVA SPOT WELDER
. . . for High Production Service


BP Co
SIMPLIFIED WELDING
A compact heavy duty bench type Spot Welder for high production operation.
Stock Delivery!
Write on your official letterhead for Bulletin SP-10A.

BANNER PRODUCTS COMPANY
MFGRS. OF RESISTANCE WELDERS AND INCANDESCENT BRAZERS
4934 N. 29TH STREET • MILWAUKEE 9, WISCONSIN

"SAF-T" CURTAINS



FOR INDUSTRIAL USES
For Top Protection for Workmen, Specify—
"SAF-T" CURTAINS
- Made of fine quality, heavy flameproof duck.
- Any size required.
- Equipped with grommets ready to hang.

Color: Olive Drab

Write for prices and descriptive material.

FRED JESSAR
1230 VINE ST., PHILADELPHIA 7, PA.

W-AL-CO RODS
for Welding of ALUMINUM

ELECTRIC AND GAS WELDING

Drawn Wire
Types 25, 43 and 52
Brazing 716 (low Melting)

FOR CAST ALUMINUM

Use Extruded Rods
Types 142, 195, 355 and 356
for Better Welding
3/16" size only

Welding Alloys Manufacturing Co.
744 Broad St., Newark 2, N. J.

Electrode Holder

2,404,437. THOMAS S. DONNELLY, JR., Detroit, assigned to BORDON MFG. CO., INC., Detroit. Filed Feb. 19, 1943, and Dec. 11, 1943. Issued July 23, 1946.

An electrode holder with a gripping mechanism, a metallic supporting member, a handle, a metallic connector and a flexible conducting member connecting the supporting member and the connector and shunting the pivotal connection between these two elements.

☆ ☆

Cylinder Holder

2,404,513. BERNARD L. MCCABE, Daly City, Calif., assigned to STUART OXYGEN CO. Filed Jan. 8, 1945. Issued July 23, 1946.

A holder for oxygen and acetylene cylinders, comprising a bottom plate having a downwardly dished portion and a raised peripheral portion to which radially extending vertical plates are attached. An upright is attached to the inner ends of these plates and other vertical plates are attached to the upright, extending radially in the same directions as the first set of plates. Straps are adapted to pass around the cylinders between the plates; the straps have holes to permit them to be slipped over bolts on the upper and lower plates. The straps are then secured by nuts.

☆ ☆

Flash-Welding Control

2,404,620. JOSEPH H. COOPER, Warren, Ohio, assigned to THE TAYLOR-WINFIELD CORP., Warren, Ohio. Filed Feb. 1, 1944. Issued July 23, 1946.

In flash-butt welding apparatus having a hydraulic cylinder to move the platen, and a follow-up valve in control of the flow of fluid under pressure to opposite ends of the cylinder, the combination of means to move a movable control element of the follow-up valve (including a d-c motor) and means to energize its armature in alternate directions and with controlled intensity. The means for energization comprises an a-c source and a circuit including in series a pair of controlled discharge devices connected in inverse parallel relation.

☆ ☆

Seam Welder

2,404,632. HANS W. HANSEN, Warren, Ohio, assigned to THE TAYLOR-WINFIELD CORP., Warren, Ohio. Filed Dec. 31, 1943. Issued July 23, 1946.

Seam-welding apparatus in which the electrode-mounting arm is mounted upon the supporting structure carrying the welding transformer. Relative movement between the workpieces and the structure is effected along a path parallel with the desired line of weld. A roller electrode is rotatably mounted on the arm by a means comprising a slidable connection permitting the electrode to be moved along the line of weld independently of relative movement between the work and arm.

Experienced WELDERS PREFER THEM

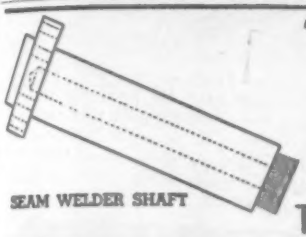
THERMACOTE • CLEAR COVER LENS
• CLEARER VISION
• DECREASES EYE STRAIN
• SPATTERPROOF • WATERPROOF
• PLASTIC COATED BOTH SIDES
THERMACOTE COMPANY
NEWARK • CHICAGO • LOS ANGELES • PORTLAND

THERMACOTE Plastic Coated Cover Lenses, slag-proof and waterproof, outlast ordinary cover glasses 25 to 1. Preferred by welders because they insure constantly clear vision and save eye strain.

THERMACOTE CO.

Newark, N. J. Los Angeles, Calif.
Chicago, Ill. Portland, Ore.

"ELECTROLOY" for RESISTANCE WELDING

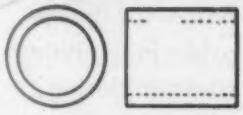


SEAM WELDER SHAFT

Butt
Flash
Spot
Seam
Projection

ELECTROLOY

Catalog and Prices on Request



SEAM WELDER BUSHING

THE ELECTROLOY CO. INC. 1600 SEAVIEW AVE. BRIDGEPORT, CONN.

"SPE-WELD" LOW TEMPERATURE WELDING RODS AND FLUXES . . . FOR ALL METALS

SPECIAL WELDING ALLOY CO. INC.

27-33 Jackson Ave. Long Island City 1, N. Y.

YOU'LL **BE WISE**

To Remember and Investigate Independent Acetylene and Oxygen Cylinders, as to quality and price—available on suitable priorities—let us know your requirements and rating and we will be glad to obtain best possible schedule for you.

INDEPENDENT Engineering Co.

DEPT. 74 O'FALLON, ILLINOIS

HELP SAVE STEEL
BY APPLYING WIESE UNITS TO AGRICULTURAL TOOLS

Prepare your shop for this type of work

U. S. Patents 2,013,818, 2,051,234 and 2,226,884

ELECTRIC WELDED

Write for new catalog now

WIESE PLOW WELDING COMPANY, PERRY, IOWA

Originally New Process Plow Welding Co.

Searchlight Section
Opportunities for Employment, Business, Used Equipment
See Page 116

ALADDIN ROD No Puddling No Flux

Weld White Metal (die cast) Braze Aluminum easily and quickly when you use ALADDIN ROD and Patented Method. The only rod guaranteed to produce welds of greater tensile strength than the original metal. Instructions with every pound. Write us for Free Literature. Rod sizes: 1/16", 1/8", 3/16", 1/4", and complete assortment.

ALADDIN ROD & FLUX MFG. CO.

Dept. A, P. O. Box 935, Madison Square Station, Grand Rapids, Mich.

GAS LIGHTERS

ROUND FILE FLAT FILE AUTOMATIC

NATION'S LARGEST ASSORTMENT

Lighters for every purpose. Renewal Flints for all makes of lighters. Write for Circular and Prices.

FLINT PRODUCTS CO. MANUFACTURERS (Established 1930) 2923 Ave. H Brooklyn 10, N. Y.

EVER-KLEAR COVER LENS

SIXTEEN YEARS OF PROVEN SERVICE

Employ Ever-Klear Lens for better welding

GOOD VISION IS IMPORTANT!

PRESERVE YOUR MOST VALUABLE POSSESSION—GOOD EYESIGHT

Avoid eye strain. For guarding your eyes against strain while doing prolonged and intensive eyetasks, as in welding, use Ever-Klear Cover Lens.

Ever-Klear Lens cannot pit or allow molten sparks to fuse on the surface.

Size 2x4½" for arc-welding shields.....$2.40 per dozen
Sizes 46½ to 50 M.M., for goggles..... 35c per pair

F. R. FAULK, DISTRIBUTOR

405 Penn Avenue Pittsburgh 22, Pa.

DOUBLE DUTY
from your Welding Torch
with a
BINGO
SOLDER KIT

Slips onto Your Welding Torch Tip

Provides an air-acetylene flame for body-soldering, tinning and silver soldering.

Uses Acetylene Only

COMPLETE KIT Consisting of body and two tips. $2.75

DISTRIBUTORS! Write for complete details.

BEAVERDELL Company

817 Webster Avenue, Chicago 14, Illinois

METAL BOND
METAL BOND MFG. CO. St. Louis U.S.A.

WELDING AND BRAZING
FLUXES
for
QUICKER, EASIER HANDLING
•
PERMANENT GOOD RESULTS

Successful welders have been using METAL BOND PRODUCTS for many years. They get uniform high quality and dependability at reasonable cost. Always abreast of newest developments—there is a METAL BOND PRODUCT for EVERY Welding or Brazing need. All METAL BOND PRODUCTS are sold on a MONEY BACK GUARANTEE.

• You can obtain complete information on the proper flux for every welding and brazing application—and how to use it properly—by writing for our CATALOG A-4 . . . Valuable! Get yours today!

METAL BOND MFG. CO.
3201 KOSSUTH AVE.
ST. LOUIS 7, MISSOURI

Electrode Holder

2,404,028. ALBERT DE WAIN BEST, Sandusky, Ohio. Filed Sept. 5, 1944. Issued July 16, 1946.

An electrode holder comprising an elongated frame having a handle at one end and the other end constituting a stationary jaw. A movable jaw is pivoted for engagement with the stationary jaw for clamping an electrode. A lever is mounted on the frame for swinging on the other side in the plane of the frame; the mounting for the lever comprises an end cam that is pivoted to the frame to engage the other end of the movable jaw. The latter jaw has a recess in which the cam seats, obviating relative side play of the movable jaw and the cam.

☆ ☆

Electrode Holder Jaw

2,404,125. THOMAS S. DONNELLY, JR., Detroit, assigned to BORDON MFG. CO., INC., Detroit. Filed Feb. 19, 1943. Issued July 16, 1946.

An electrode-clamping jaw having a projecting, longitudinally tapered rib on the back face and an insulation plate grooved for reception of the rib. The groove is tapered and slidable on the rib and engages it as a press fit. The insulation plate is of greater width than the jaw and projects laterally outwardly from the sides.

☆ ☆

Flash-Welding Method

2,403,076. WILLIAM C. HEATH, Shorewood, Wis., assigned to A. O. SMITH CORP., Milwaukee. Filed April 2, 1943. Issued July 2, 1946.

In the flash welding of a V-shaped edge piece to a foil in the construction of an airplane propeller, the steps of forging temporary integral projections on the peak of the edge piece securing extensions to the projections and placing the piece in a welding electrode which confines them with a wedging action and with the longitudinal edges exposed for welding. The extensions are secured to the electrode to prevent movement of the piece during welding. After a foil has been flash welded to an edge of the piece, the latter is removed from the electrode, and the projections are then permanently removed from the edge piece.

☆ ☆

Spot-Welding Electrode

2,402,646. CHESTER F. LEATHERS, Detroit. Filed July 10, 1944. Issued June 25, 1946.

A spot-welding electrode having a body and a work-engaging tip with surfaces which coöperate to define a coolant circuit. The body and tip have telescopic, slidable engaged surfaces which enable them to be assembled or disassembled without disrupting the bond between them. There is also a sealing means to prevent the coolant from leaking at the junction between body and tip.

For Clamping Jobs that Can Be Done in No Other Way!

No. 610 Simplex Util-A-Tool. 10-tons capacity; 4¾" screw travel.

The Util-A-Tool clamps and securely holds parts for welding; including the clamping jobs that can be performed by no other method. Also pushes, pulls, spreads and lifts. A real manpower saver. Write for Bulletin P&P 45.

Simplex
LEVER SCREW - HYDRAULIC
Jacks

Templeton, Kenly & Co.
Chicago (44), Illinois
Better, Safer Jacks Since 1899

"Jorgensen"
CLAMPS

FOR WELDERS
"Jorgensen"
Extra Quality

Series 120 Body Clamps. A large variety of "C" Clamps and Bar Clamps to choose from—

Send for Catalog No. 16
Ask for them by name—

ADJUSTABLE CLAMP CO.
"The Clamp Folks"
426 N. Ashland Ave., Chicago 22, U. S. A.

HARGRAVE
TESTED CLAMPS
INDIVIDUALLY TESTED
• WELDING
• DEEP REACH
• QUICK ACTING
• FORGED STEEL

Write for new catalog showing a clamp for every purpose.

Ask your supply house
The Cincinnati Tool Co.
1944 Waverly Ave. Cincinnati 12, O.

Welded Crankshafts

2,403,049. FRITZ A. CARSTENS, Milwaukee, assigned to A. O. SMITH CORP., Milwaukee. Filed Aug. 31, 1942. Issued July 2, 1946.

In the manufacture of crankshafts for large Diesel engines from separately forged and heat-treated parts the steps of welding two cheek units together by providing a welding dam spacing the faces of corresponding pin stubs on the units to provide two substantially equal welding grooves. The units are mounted in a fixture with the welding dam disposed horizontally, and a layer of weld metal is deposited in the groove above the dam from a metal welding electrode. The fixture is then rotated to present the other welding groove uppermost, and weld metal is similarly deposited in the second groove. Additional layers of metal are alternately and similarly deposited, the weld metal being peened as successive deposits are cooled. End dams retain the weld metal at the end edges of the grooves until the latter have been completely filled; the dams are removed as the last step prior to machining.

☆ ☆

Descaling Torch

2,398,884. JOHN I. CROWE, Westfield, N. J., assigned to AIR REDUCTION CO., INC., New York City. Filed Dec. 15, 1943. Issued April 23, 1946.

A descaling torch comprising an elongated block in which two rows of gas passages terminate in two rows of discharge orifices in a face of the block. Oxygen is delivered to all passages of one row and fuel gas to all of the passages of the other row. The passages of the two rows have no communication within the block but are adapted to discharge the oxygen and fuel gas separately from the torch and cause them to mix externally. Each of the passages of one of the rows is of Venturi shape to increase the velocity of the gas passing through it.

☆ ☆

Improved Welding Stud

2,402,659. TED NELSON, San Leandro, Calif. Filed Feb. 20, 1943. Issued June 25, 1946.

An improvement in a welding stud having a recess in the end, a flux in the recess, and a cap over the recess to confine the flux. The improvement comprises a point centrally disposed on the cap to facilitate placement of the stud.

☆ ☆

Patents Available for Licensing or Sale

2,393,830. Electrode Holder. Issued Jan. 29, 1946. An electrode holder capable of holding an electrode in a wide variety of angular positions during welding, the electrode holder being constructed to quickly release or clamp the electrode in any of such positions. (Owner) ALBERT H. SMITH, 8632 Elizabeth Ave., South Gate, Calif.

The Wheels of Industry Turn Again!
—Breaks are welded with

SHAWINIGAN PRODUCTS CORPORATION
1317 EMPIRE STATE BLDG., 350 FIFTH AVE., NEW YORK 1, N.Y.

ABUSE MEANS NOTHING TO ST. PIERRE CHIPPING HAMMERS

Breaks Scale Cleans Surface ONE OPERATION

Here's a man-sized brush in the right position for easy use after chipping scale from welded surface. Hammer-Chisel made of highest quality tool steel. Entire tool is well-balanced. For economy, for durability use ST. PIERRE Hammers.

Order Today From Your Jobber or Direct

ST. PIERRE Chain Corporation WORCESTER MASSACHUSETTS

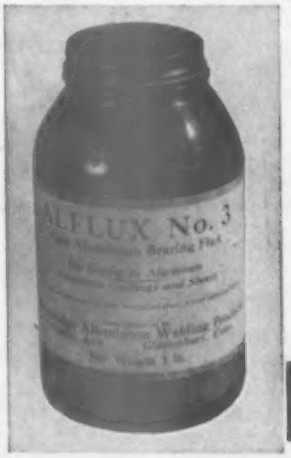
W-AL-CO

WHITE METAL FILLER ROD

No. 716 LOW-MELTING ALUMINUM BRAZING ROD

ALUMINUM SOLDER

WELDING ALLOYS MANUFACTURING CO. 744 Broad St., Newark 2, N. J.



WOOLDRIDGE ALFLUX No. 3 CAST ALUMINUM BRAZING FLUX

ALFLUX No. 3 is a multiple purpose flux which has been developed especially

for Soldering

COPPER TO ALUMINUM • STEEL TO ALUMINUM

and Brazing

ALUMINUM CASTINGS • ALUMINUM SHEETS

This flux may also be used with good results on other metals. ALFLUX No. 3 is manufactured of the highest quality pure chemicals which have been thoroughly and carefully compounded. It is an exceptionally fine flux which adheres to the surface to be brazed and produces a faster and more economical weld.

Mfd. by WOOLDRIDGE ALUMINUM WELDING PRODUCTS, INC. · Glastonbury, Conn.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:
(Not available for equipment advertising)
10 cents a word, minimum charge $2.00.
(See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time individual salaried employment only), ½ above rates.
PROPOSALS, 50 cents a line an insertion.

INFORMATION:
BOX NUMBERS care of publication New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.
DISCOUNT of 10% if full payment is made in advance of four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:
The advertising rate is $6.75 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request. AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. W. E.

NEW ADVERTISEMENTS received by September 12 will appear in the October issue, subject to limitation of space available

EDUCATIONAL

BEST PAID WELDING JOBS go to men who are best trained. Get thorough training at this outstanding arc welding school operated under G. I. Bill. Expert instructors, individual attention and latest type practice machines. Write today for full details and low cost. Hobart Welding School, Box U-962, Troy, Ohio.

WANTED

OXY. PLT. operator. Rocky Mt. area, possibilities. Box II—P-107.

POSITIONS WANTED

Welding Supervisor. Major in metallurgy. Ten years pre-war experience in all phases of welding. Specialized shop and field welding refineries, power piping pressure vessels. Knows sales. Some knowledge of piping design. Write Box No. PW-109.

SURPLUS
SCIAKY ALUMINUM WELDERS

They are thoroly factory-reconditioned, installed, serviced and "new-machine" guaranteed by ***the original maker.***

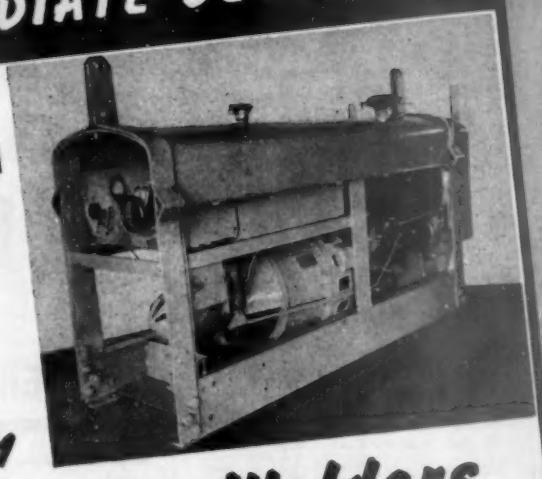
They are offered at a savings of nearly one half. Welders formerly $9,100 to $10,160 are priced at $5,500 to $6,000, complete with rectifier . . . some with built-in rectifiers.

The machines are rated 50 KW and operate on the exclusive Sciaky Electromagnetic "Stored Energy" principle with patented "Variable Pressure Cycle." Capacity on aluminum and other light alloys: .016" plus .016" up to and including .080" plus .080". Speed on two thicknesses of .040" is 80 spots per minute. Throat depth is 36".

The quantity is limited. You are urged to act at once. Write, phone or wire for details.

SCIAKY BROS. Inc.
4915 W. 67th St. Chicago 38, Ill.

IMMEDIATE DELIVERY!



Reconditioned
LINCOLN
HOBART
G. E.
300 AMP.

Gas Driven Portable Arc Welders

Your choice of thoroughly reconditioned LINCOLN, HOBART or GENERAL ELECTRIC gas-driven 300 AMP. Portable Arc Welders . . . Suitable for stationary use or can be mounted on truck or wheels. *Reasonable prices—terms.*

WRITE OR WIRE TODAY TO

INDUSTRIAL AIR PRODUCTS CO.
ATwater 0201 • 3200 N.W. Yeon Ave., Portland, Ore.

IMMEDIATE DELIVERY SPOT WELDERS ALL SIZES
WITH FIVE YEAR GUARANTEE
5 to 300 KVA "Larkin Welders," 6" to 36" Throat
PAUL'S MACHINERY CO.
6111 VERMONT AVE. TEL. TYLER 7-6300 DETROIT 18, MICH.

FOR SALE

Several thousand Government Cylinders. New and Used, Oxygen, Acetylene, Nitrogen, Hydrogen CO2 priced to sell.
National Welders Supply Co.
Charlotte, N. C.

FOR EVERY
BUSINESS WANT
"Think Searchlight First"

FOR SALE

"LINKEM" connectors for welding cables resemble ordinary cable lugs; but each "Linkem" lug mates with and may be self connected with any other "Linkem" lug. Linkems may be un-linked readily, but no twist or yank in service can cause them to disengage.

In shop or field, in managing welding cable lines, link 'em with Linkem connectors. Pair postpaid $2.00.

MAJOR PRODUCTS COMPANY
601 Hughes Avenue • Des Moines 15, Iowa